

TECHNICAL SPECIFICATIONS

SHERBECK FIELD IMPROVEMENT PROJECT

AT

FULLERTON COLLEGE

321 E. Chapman Avenue
Fullerton, CA 92832

NORTH ORANGE COUNTY COMMUNITY COLLEGE DISTRICT

1830 Romneya Drive
Anaheim, CA 92801-1819
Tel. (714) 808-4500



WW Project No. 20012.00

October 11th, 2021

Contact: John Garakian, Project Manager

WESTBERGWHITE, Inc.

14471 Chambers Road

Tustin, CA 92780

Tel. (714) 508-1780, ext. 314

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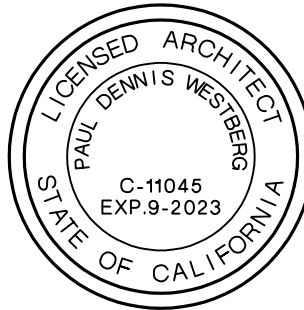
DSA Application No. 04-119743.

WW Project No. 20012.00

October 11th, 2021

ARCHITECT

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Tel. 714.508.1780



IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT

APP: 04-119743 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 11/18/2021

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SECTION 01 1100

SUMMARY OF WORK

PART 1 GENERAL

1.01 PROJECT DESCRIPTION

- A. Project consists of Improvements to Sherbeck Field, at Fullerton College, Fullerton California, for North Orange County Community College District, Anaheim. California, as shown on Contract Documents prepared by WestbergWhite, Inc., Architects.
- B. Work includes, but is not necessarily limited to following:
 - 1. Site clearing and grading.
 - 2. Construction of new 600 sq. ft. Storage Building.
 - 3. New site improvements.
- C. Site Clearing Work Consisting of:
 - 1. Removal of existing turf and regrading in area of field improvements.
- D. New Construction Consisting of:
 - 1. New single story concrete masonry storage building, 14 feet high by 30 feet wide by 20 feet deep for total area of 600 square feet, with painted Portland cement plaster finish.
 - a. Building Construction Includes:
 - 1) Parapet perimeter with sloped standing seam metal roof.
 - 2) Overhead coiling door.
 - 3) Single swing hollow metal door and frame.
 - a) Including required door hardware.
 - 2. Additional Work includes:
 - a. Wall racks for pole vault poles and javelins.
 - b. Exterior hose bibb.
 - c. Electrical Power:
 - 1) On building exterior for charging equipment and golf carts.
 - 2) Interior lighting and convenience power outlets
 - d. Intrusion detection
 - e. Fire alarm system
- E. Site Improvement Work Consisting of:
 - 1. New concrete paving for accessible concrete pathway and drainage swale.
 - 2. New asphalt paving under Home bleachers.
 - 3. Chain Link Fencing and Gates:
 - a. Includes fence posts set in concrete footings.
 - 4. Decorative Metal Fences and Gates – Alternate:
 - a. Includes fence posts set in concrete footings.
 - 5. Exterior Lighting:
 - a. Site lighting
 - b. Athletic Field Lighting:
 - 1) Provided by Musco Lighting.
 - 6. Field Sound System and assistive listening system
 - 7. Utility Connections for water and power.

1.02 WORK UNDER SEPARATE CONTRACT

- A. Following Work will be performed by bleacher manufacturer's subcontractor/structural engineer:
 - 1. Design, construction, and installation of new aluminum bleachers:
 - a. Work includes ramps and stairs.
 - 2. Related concrete foundation work consisting of:
 - a. Concrete pad and foundation under Visitor's Bleachers.
 - b. Concrete pier footings for Home Bleachers.

1.03 PROCUREMENT AND CONTRACTING DOCUMENTS

- A. Use Division 00 Procurement and Contracting Requirements provided by North Orange County Community College District for Sherbeck Field Improvement Project at Fullerton College.

1.04 RELATED DOCUMENTS

- A. Refer to District's Division 00 Documents, including General Conditions, and other Division 01 Sections, for additional requirements.
- B. Comply with requirements of these specifications and District's Division 00 documents.
 - 1. Where differences may occur between specifications and District 00 documents, requirements of District's 00 documents govern, unless otherwise directed.
 - 2. Changes to approved documents will be made by addenda or change order approved by Owner/Architect.
- C. Contract Documents are complementary and what is required by one is as binding as when required by all.
 - 1. Report errors, inconsistencies, or omissions discovered by Contractor promptly to Owner/Architect as request for information.

1.05 CONSTRUCTION REQUIREMENTS

- A. Construct Work conforming to requirements of California Code of Regulations (CCR), Title 24, Part 2, 2016 California Building Code (CBC), Volumes 1 and 2.
 - 1. Refer to Section 01 4200 for additional references.

1.06 CONTRACTS

- A. Construct Work under single fixed-price contract.

1.07 WORK SEQUENCE

- A. General:
 - 1. Conform to construction schedule as specified.
 - 2. Construction Time:
 - a. Starts as of date specified in initial "Notice to Proceed" from Architect to Contractor and ends with date of acceptance of Work by Owner.

- B. Construction Schedule:
 - 1. Work will be conducted in single phase and provide least possible interference with activities of Owner's personnel and to permit orderly transfer of personnel and equipment to new facilities.
- C. Liquidated Damages:
 - 1. Liquidated damages will be assessed under conditions provided in Agreement.

1.08 CONTRACTOR'S USE OF PREMISES

- A. General:
 - 1. During construction period, limit use of premises to immediate area required for construction operations.
 - 2. Use of premises is also limited by Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of Project.
- B. Limit use of premises for Work and for storage as directed, to allow for:
 - 1. Work by other Contractors.
 - 2. Owner occupancy.
 - 3. Use by Public.
- C. Coordinate use of premises under direction of Architect and Owner.
- D. Assume full responsibility for protection and safekeeping of products under this contract, stored on Project Site.
- E. Move stored products under Contractor's control, which interfere with operations of Owner or separate contractor.
- F. Obtain and pay for use of additional storage or work areas needed for operations.

A. WORK DURING COLLEGE SESSIONS

- B. Work under this contract will be executed in part during regular sessions of School.
 - 1. Cooperate with College authorities in every way to minimize disturbance.
- C. In entrance and exit of workers, and in bringing in, storing, and removal of equipment, cooperate with those in authority and prevent interference with functioning of College.
 - 1. Observe rules and regulations in force and avoid unnecessary dust, mud or accumulated debris, or undue interference with convenience, sanitation or routine of departmental activities.
- D. In connecting new utilities to existing, and similar operations, time and coordinate such operations so that there will be no interference with College activities.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 1100

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SECTION 01 2300

ALTERNATES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Section identifies each Alternate by number, and describes basic changes to be incorporated into Work, only when that Alternate is made part of Work by specific provisions in Owner-Contractor Agreement.
 - 2. This information will be repeated on Bid Form.
- B. Related Requirements in Other Parts of Project Manual:
 - 1. Method of quotation of cost of each Alternate, and basis of Owner's acceptance of Alternates: Bidding Documents.
 - 2. Incorporation of Alternates into Work: Owner-Contractor Agreement.
- C. Related Requirements Specified in Other Sections:
 - 1. Sections of Specifications as listed under respective Alternates.
- D. Referenced sections of specifications stipulate pertinent requirements for products and methods to achieve work stipulated under each Alternate.
- D. Coordinate pertinent related work and modify surrounding work as required to properly integrate work under each Alternate, and to provide complete construction required by Contract Documents.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 SCHEDULE OF ALTERNATES

- A. **Alternate 1:**
 - 1. Base Bid:
 - a. Work includes:
 - 1) Provide 8 Foot High Chain Link Fence at North and South Perimeters of Field as indicate on Drawings and specified in Section 32 3113.
 - a) Black Vinyl Coated Finish.
 - 2. Alternate:
 - b. Work includes:
 - 1) In lieu of 8 foot high chain link fence, provide 8 Foot high Decorative Metal Fence at North and South Perimeters of Field as indicated on Drawings and specified in Section 32 3119.
 - a) Black Powder Coated Finish.
 - 3. Alternate is identified as follows:
 - a. 'ALT 1' on Details.

END OF SECTION 01 2300

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SECTION 01 2610

CONSTRUCTION DOCUMENT MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements for handling and processing Construction Document Modifications to Contract.

1.02 MINOR CHANGES IN WORK

- A. Supplemental instructions authorizing minor changes in Work, not involving adjustment to Contract Sum or Contract Time, will be issued by Architect on *AIA form G710 - Architect's Supplemental Instructions*.

1.03 CONSTRUCTION CHANGE DOCUMENT APPROVAL REQUESTS

- A. Construction Change Documents will not be allowed without Division of the State Architect (DSA) approval.
- B. Owner-Initiated Change Requests:
 - 1. Proposed changes in Work that will require adjustment to Contract Sum or Contract Time will be issued by Architect, with detailed description of proposed change and supplemental or revised Drawings and Specifications, when necessary.
 - 2. Change requests issued by Architect are for information only.
 - a. Do not consider them an instruction either to stop Work in progress, or to execute proposed change.
 - 3. Unless otherwise indicated in change request, within ten days of receipt of change request, submit to Architect for Owner's review, estimate of cost necessary to execute proposed change.
 - a. When no estimate of cost is submitted within 10 days it will be assumed to be "no cost change".
 - b. Include list of quantities of products to be purchased and unit costs, along with total amount of purchases to be made.
 - c. Provide breakdown of labor cost involved with the proposed change.
 - 1) Where requested, furnish survey data to substantiate quantities.
 - d. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - e. Include statement indicating effect proposed change in Work will have on Contract Time.
- C. Contractor-Initiated Change Requests:
 - 1. When latent or other unforeseen conditions require modifications to Contract, Contractor may propose changes by submitting request for change to Architect.
 - a. Notify Owner within ten days of occurrence leading to such request or request will be denied and Contractor will not be entitled to additional compensation.

2. Include statement outlining reasons for change and effect of change on Work.
 - a. Provide complete description of proposed change.
 - b. Indicate effect of the proposed change on Contract Sum and Contract Time.
 3. Include list of quantities of products to be purchased and unit costs along with total amount of purchases to be made. .
 - a. Provide breakdown of labor cost involved with proposed change.
 - b. Where requested, furnish survey data to substantiate quantities.
 4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 5. Comply with requirements in Section 01 6000, when proposed change in Work requires substitution of one product or system for product or system specified.
- D. Construction Change Document:
1. *DSA Form 140 – Application for Approval of Construction Change Document – CCD Category A.*
 2. Form will be prepared by Architect for approval by DSA.

1.04 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive:
1. When Owner and Contractor are not in total agreement on terms of Change Order Proposal Request, Architect may issue Construction Change Directive on *AIA Form G714*, instructing Contractor to proceed with change in Work, for subsequent inclusion in Contract.
 2. Construction Change Directive will contain complete Construction Change Document and designate method to be followed to determine change in Contract Sum or Contract Time.
- B. Documentation:
1. Maintain detailed records on time and material basis of work required by Construction Change Directive.
 2. After completion of change, submit itemized account and supporting data necessary to substantiate cost and time adjustments to Contract.

1.05 CONTRACT CHANGE ORDER PROCEDURES

- A. Upon DSA approval of Construction Change Document DSA Form 140, Architect will issue Construction Change Documents for signatures of Owner and Contractor on proper approved form, as provided in General Conditions of the Contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 2610

SECTION 01 2976

PROGRESS PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements governing Contractor's applications for payment.
- B. Related Sections:
 - 1. Section 01 2610: Construction Document Modification Procedures
 - 2. Section 01 7700: Closeout Procedures
 - 3. Section 01 7839: Project Record Documents
- C. Related Requirements:
 - 1. Refer to District's Division 00 Documents, including General Conditions, for requirements related to Contractor's Construction Schedule, Submittal Schedule, and Progress Payments Procedures.

1.02 SCHEDULE OF VALUES

- A. Coordinate preparation of Schedule of Values with preparation of Contractor's construction schedule.
 - 1. Correlate line items in Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's Construction Schedule.
 - b. Application for Payment form.
 - c. List of Subcontractors.
 - d. Schedule of Alternates.
 - e. List of products.
 - f. List of principal suppliers and fabricators.
 - g. Schedule of Submittals.
 - 2. Submit Schedule of Values to Architect at earliest feasible date, but in no case later than fourteen days before date scheduled for submittal of initial application for payment.
 - 3. Sub-Schedules: Where Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
- B. Format and Content:
 - 1. Include following project identification on Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange Schedule of Values in tabular form with separate columns to indicate following for each item listed:
 - a. Generic name.

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- b. Related specification section.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that have affected value.
 - g. Dollar value.
 - h. Percentage of Contract sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of applications for payment and progress reports.
 - a. Break principal subcontract amounts down into several line items.
4. Round amounts off to nearest whole dollar, with total equal to Contract Sum.
5. For each part of Work where application for payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of Work.
6. Margins of Cost:
 - a. Show line items for indirect costs, and margins on actual costs, only to extent that such items will be listed individually in applications for payment.
 - b. Complete each item in Schedule of Values and applications for payment including its total cost and proportionate share of general overhead and profit margin.
 - c. At Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in Schedule of Values or distributed as general overhead expense.
7. Schedule Updating:
 - a. Update and resubmit Schedule of Values when Change Orders or Construction Change Directives result in change in Contract Sum.
 - b. Submit along with updated construction schedule prior to monthly progress payment submittal

1.03 APPLICATIONS FOR PAYMENT

- A. Ensure that each application for payment is consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial application for payment, application for payment at time of Substantial Completion, and final application for payment involve additional requirements.
- B. Payment Application Times:
 1. Date for each progress payment is 5th day of each month,
 2. Period of construction Work covered by each application for payment is period ending fifteen days prior to date for each progress payment and starting day following end of preceding period.
- C. Payment Application Forms:
 1. Use *AIA Document G702 –Application and Certification For Payment* as form for application for payment or approved equal.
- D. Application Preparation:
 1. Complete every entry on form, including notarization and execution by person authorized to sign legal documents on behalf of Owner.

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- a. Incomplete applications will be returned without action.
 2. Ensure entries match data on Schedule of Values and Contractor's construction schedule.
 - a. Use updated schedules when revisions have been made.
 3. Include amounts of approved Change Orders issued prior to last day of construction period covered by application.
- E. Transmittal:
1. Submit five executed copies of each application for payment to Architect by means ensuring receipt within twenty-four hours.
 - a. Transmit one completed copy, including waivers of lien and similar attachments, when required.
 - b. Transmit each copy with transmittal form listing attachments, and recording appropriate information related to application in manner acceptable to Architect.
- F. Waivers of Mechanics Lien:
1. When requested by Architect or Owner, with each application for payment, submit waivers of mechanics lien from every entity who may lawfully be entitled to file mechanics lien arising out of Contract, and related to Work covered by payment.
- G. Initial Application for Payment:
1. Administrative actions and submittals that must precede or coincide with submittal of first application for payment include following:
 - a. List of subcontractors.
 - b. List of principal suppliers and fabricators.
 - c. Schedule of Values.
 - d. Contractor's Construction Schedule (preliminary if not final).
 - e. Submittal Schedule (preliminary if not final).
 - f. Certificates of insurance and insurance policies.
 - g. Performance and Payment Bonds
- H. Application for Payment at Substantial Completion:
1. Following issuance of Certificate of Substantial Completion, submit application for payment.
 2. Submit Application reflecting Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of Work.
- I. Administrative actions and submittals that precede or coincide with application include:
1. Occupancy permits and similar approvals.
 2. Warranties/guarantees and maintenance agreements.
 3. Test/adjust/balance records.
 4. Maintenance instructions.
 5. Meter readings.
 6. Start-up performance reports.
 7. Changeover information related to Owner's occupancy, use, operation and maintenance.
 8. Final cleaning.
 9. Application for reduction of retainage, and consent of surety.
 10. Advice on shifting insurance coverage.
 11. Record Drawings and Specifications.

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12. Final progress photographs.
13. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

J. Final Payment Application:

1. Administrative actions and submittals that must precede or coincide with submittal of final payment application for payment include following:
 - a. Completion of project closeout requirements.
 - b. Completion of items specified for completion after Substantial Completion.
 - c. Assurance that unsettled claims will be settled.
 - d. Assurance that Work not complete and accepted will be completed without undue delay.
 - e. Transmittal of required project construction records to Owner.
 - f. Proof that taxes, fees and similar obligations have been paid.
 - g. Removal of temporary facilities, controls, and services.
 - h. Removal of surplus materials, rubbish and similar elements.
 - i. Change of door locks to Owner's access.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 2976

SECTION 01 3113

PROJECT COORDINATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
 - a. Coordination.
 - b. Administrative and supervisory personnel.
 - c. General installation provisions.
 - d. Cleaning and protection.
- B. Related Sections:
 - 1. Section 01 3300: Submittal Procedures; product and material submittals.
 - 2. Section 01 7423: Cleaning; general project cleaning
- C. Related Requirements:
 - 1. Refer to District's Division 00 Documents, including General Conditions, for requirements related to Contractor's Construction Schedule and Submittal Schedule.

1.02 COORDINATION

- A. Coordination:
 - 1. Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of Work.
- B. Coordinate construction operations included under different Sections of Specifications that are dependent upon each other for proper installation, connection, and operation.
 - 1. Where installation of one part of Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in sequence required to obtain best results.
 - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination.
 - 1. Include such items as required notices, reports, and attendance at meetings.
 - 2. Prepare similar memoranda for Owner and separate Contractors where coordination of their Work is required.

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- D. Administrative Procedures:
 - 1. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of Work.
 - 2. Such administrative activities include, but are not necessarily limited to, following:
 - a. Preparation of schedules.
 - b. Installation and removal of temporary facilities.
 - c. Delivery and processing of submittals.
 - d. Progress meetings.
 - e. Project Close-out activities.
- E. Conservation:
 - 1. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water and materials.
 - 2. Salvage materials and equipment involved in performance of, but not actually incorporated in, Work.
 - 3. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

1.03 SUBMITTALS

- A. Staff Names:
 - 1. Within fifteen days of Notice to Proceed, submit list of Contractor's principal staff assignments, including Superintendent and other personnel in attendance at Project Site
 - 2. Identify individuals, their duties and responsibilities
 - a. List their addresses and telephone numbers.
 - 3. Post copies of list in Project meeting room, temporary field office and each temporary telephone.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions:
 - 1. Require installer of each major component to inspect both substrate and conditions under which Work is to be performed.
 - 2. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions:
 - 1. Comply with manufacturer's installation instructions and recommendations, to extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation.
 - 1. Reject damaged and defective items.

- D. Provide attachment and connection devices and methods necessary for securing Work.
 - 1. Secure Work true to line and level.
 - 2. Allow for expansion and building movement.
- E. Visual Effects:
 - 1. Provide uniform joint widths in exposed Work.
 - 2. Arrange joints in exposed Work to obtain best visual effect.
 - 3. Refer questionable choices to Architect for final decision.
- F. Recheck measurements and dimensions before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure best possible results.
 - 1. Isolate each part of completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize necessity of uncovering completed construction for that purpose.
- I. Mounting Heights:
 - 1. Where mounting heights are not indicated, install individual components at standard mounting heights recognized within industry for particular application indicated.
 - 2. Comply with requirements of Chapter 11B of CBC for accessible mounting heights of toilet accessories and like items.
 - 3. Refer questionable mounting height decisions to Architect for final decision.

3.02 CLEANING AND PROTECTION

- A. Comply with requirements of Section 01 7423.
- B. During handling and installation, clean and protect construction in progress and adjoining materials in place.
 - 1. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- C. Clean and maintain completed construction as frequently as necessary through remainder of construction period.
 - 1. Adjust and lubricate operable components to ensure operability without damaging effects.
- D. Limiting Exposures:
 - 1. Supervise construction activities to ensure that no part of construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

END OF SECTION 01 3113

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SECTION 01 3119
PROJECT MEETINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements for project meetings including but not limited to:
 - a. Pre-Construction Conference
 - b. Progress Meetings
 - c. Scheduling Conference
- B. Related Sections:
 - 1. Section 01 3113: Project Coordination
 - 2. Section 01 3300: Submittals
- C. Related Requirements:
 - 1. Refer to various Sections for pre-construction and pre-installation meeting requirements
 - 2. Refer to District's Division 00 Documents, including General Conditions, for requirements related to Contractor's Construction Schedule.
 - 3. Requirements for Contractor's Construction Schedule are included in Section 01 3300.

1.02 PRE-CONSTRUCTION CONFERENCE

- A. Schedule pre-construction conference and organizational meeting at Project Site or other convenient location no later than 15 days after execution of Agreement and prior to commencement of construction activities.
 - 1. Conduct meeting to review responsibilities and personnel assignments.
- B. Attendees:
 - 1. Owner, Architect and their consultants.
 - 2. Contractor and his superintendent.
 - 3. Major subcontractors, manufacturers, suppliers.
 - 4. Other concerned parties.
 - 5. Persons representing each party in attendance must be familiar with and authorized to conclude matters relating to Work.
- C. Agenda:
 - 1. Discuss items of significance that could affect progress including such topics as:
 - a. Tentative construction schedule.
 - b. Critical Work sequencing.
 - c. Designation of responsible personnel.
 - d. Procedures for processing field decisions and Change Orders.
 - e. Procedures for processing Applications for Payment.
 - f. Procedures for processing Requests for Information (RFI).
 - g. Distribution of Contract Documents.

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- h. Submittal of Shop Drawings, Product Data and Samples.
- i. Preparation of Record Documents.
- j. Access to Project Site and use of premises.
- k. Office, Work and storage areas.
- l. Equipment deliveries and priorities.
- m. Safety procedures.
- n. First aid.
- o. Security.
- p. Working hours.

1.03 PROGRESS MEETINGS

- A. Conduct weekly progress meetings at Project Site.
 - 1. Coordinate dates of meetings with preparation of payment request.
- B. Attendees:
 - 1. Representatives of
 - a. Owner and Architect,
 - b. Representatives of each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities.
 - c. Persons representing each party in attendance at these meetings must be familiar with and authorized to conclude matters relating to progress.
- C. Agenda:
 - 1. Review and correct or approve minutes of previous progress meeting.
 - 2. Review other items of significance that could affect progress.
 - 3. Include topics for discussion as appropriate to current status of Project.
 - 4. Contractor's Construction Schedule:
 - a. Review progress since last meeting.
 - b. Determine where each activity is in relation to Contractor's Construction Schedule, whether on time or ahead or behind schedule.
 - c. Determine how construction behind schedule will be expedited
 - 1) Secure commitments from parties involved to do so.
 - d. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within Contract Time.
 - 5. Review present and future needs of each entity present, including such items as:
 - a. Interface requirements.
 - b. Time.
 - c. Sequences
 - d. Coordination of Work.
 - e. Deliveries.
 - f. Off-site fabrication problems.
 - g. Access.
 - h. Site utilization.
 - i. Temporary facilities and services.
 - j. Hours of Work.
 - k. Hazards and risks.
 - l. Housekeeping.
 - m. Quality and Work standards.
 - n. Construction progress
 - o. Progress Schedule and Submittals.

- p. Change Orders.
- q. Documentation of information for payment requests.

D. Meeting Records:

- 1. Recording of minutes of each meeting will be by Contractor.
 - a. Furnish copies within reasonable time to Owner, Architect, and other attendees.
 - b. Unless written objections to contents of meeting minutes are received by Contractor within five days of distribution of meeting minutes, it is understood and agreed upon that minutes are true and complete record of meeting.
 - c. Schedule Updating:
 - 1) Revise construction schedule after each progress meeting where revisions to schedule have been made or recognized.
 - 2) Issue revised schedule within seven calendar days of meeting.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 3119

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SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Procedural requirements for non-administrative submittals for work-related submittals required for performance of Work and by Contract Documents, including, but not necessarily limited to:
 - a. Submittal Schedule.
 - b. Product Data.
 - c. Shop Drawings.
 - d. Samples
 - e. Verified Reports
- B. Related Sections:
 - 1. Section 01 3113: Project Coordination
 - 2. Section 01 4100: Regulatory Requirements; submittals to regulatory agencies.
 - 3. Section 01 4200: References; submittals to regulatory agencies.
 - 4. Section 01 4500: Quality Control: inspection and testing submittals
 - 5. Section 01 6000: Products Requirements; request for substitution submittals.
- C. Related Requirements:
 - 1. Refer to District's Division 00 Documents, including General Conditions, and other Division 01 Sections, for specifications for administrative submittals and additional requirements.
 - a. Administrative Submittals include, but are not necessarily limited to:
 - 1) Permits.
 - 2) Applications for Payment.
 - 3) Performance and Payment Bonds.
 - 4) Insurance Certificates.
 - 5) Inspection and Test Reports.
 - 6) Schedule of Values.
 - 7) Progress Schedule.
 - 8) Listing or designation of subcontractors.
 - 9) Record Drawings.
 - 10) Commissioning Requirements
 - 2. Refer to Division 02 through 33 Sections where more specific Submittal Requirements are indicated
- D. Substitutions:
 - 1. Contractor's submittal and Architect's acceptance of Product Data, Shop Drawings, or Samples that relate to construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.
 - 2. Product Data, Shop Drawing and Sample Submittals containing substitutions for specified items will be rejected and returned as not in compliance with Contract Documents.

3. Refer to Section 01 6000 for required procedures for submitting substitution requests.

1.02 SUBMITTAL PROCEDURES AND REQUIREMENTS

- A. Coordination:
 1. Coordinate preparation and processing of submittals with performance of construction activities.
 2. Designate in Progress Schedule, or in separate coordinated schedule, dates for submission and dates reviewed shop drawings, product data and samples will be needed for each product.
 - a. Identify items requiring long lead times.
 - 1) Make submittals for such items as soon as possible, but not later than fifteen days after Notice of Award of Contract.
- B. Timing of Submittals:
 1. Make submittals promptly in accordance with approved schedule, sufficiently in advance of performance of related construction activities, and in such sequence as to not cause delay in Work or in Work of other contractors.
 2. Schedule submissions at least 21 working days before dates reviewed submittals will be needed.
- C. Number of Submittals Required:
 1. Number stated in each specification section, or as follows:
 - a. Product Data and Shop Drawings:
 - 1) One electronic copy as specified under "Electronic Submittals".
 - b. Samples:
 - 1) Number stated in each specification section or, when not stated, minimum of four.
 - c. Warranties, Maintenance Agreements, Industry Standards, and Operation/Maintenance Manuals:
 - 1) Two copies.
- D. Submittal Preparation:
 1. Place permanent label or title block on each submittal for identification.
 2. Indicate name of entity that prepared each submittal on label or title block.
 3. Include following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Submittal reference number assigned by Contractor; this number should not be specification section number.
 - d. Specification section number to which submittal applies.
 - 1) Do not reference drawing/detail numbers unless accompanied by specification section number.
 4. Accompany submittals with transmittal form containing:
 - a. Date.
 - b. Project title and number.
 - c. Name and address of:
 - 1) Architect.
 - 2) Contractor.
 - 3) Subcontractor.
 - 4) Supplier

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- 5) Manufacturer.
 - 6) Separate detailer, when pertinent.
 - d. Number of each shop drawing, product data and sample submitted.
 - e. Notification of deviations from Contract Documents.
 - f. Other pertinent data.
 - g. Interactive Submittal Transmittal Form will be provided to Contractor at Pre-Construction Meeting..
- E. Include following on Submittals:
 - 1. Data and revision dates:
 - 2. Project title and number.
 - 3. Identification of product or material.
 - 4. Relation to adjacent structure or materials.
 - 5. Field dimensions, clearly identified as such.
 - 6. Specification section number.
 - 7. Applicable standards, such as ASTM number or Federal Specification.
 - 8. Blank space, 8 inches x 3 inches, for Contractor and Architect stamps.
 - 9. Identification of deviations from Contract Documents.
 - 10. Contractor's stamp, initialed or signed, certifying review of submittal, verification of field measurements, and compliance with Contract Documents.
 - a. Submittals without Contractor's stamp and signature will be returned by Architect without review.
- F. Processing:
 - 1. Allow sufficient review time so that installation will not be delayed as result of time required to process submittals, including time for resubmittals.
 - 2. Allow minimum of 21 days from date of receipt of complete submittal for Architect's initial review and return of submittals.
 - 3. Allow additional time if processing must be delayed to permit coordination with subsequent submittals.
 - 4. Architect reserves right to withhold action on submittal requiring coordination with other submittals until related submittals are received.
 - 5. Architect will promptly advise Contractor when submittal being processed must be delayed for coordination.
 - 6. No extension of Contract Time will be authorized because of failure to transmit submittals to Architect sufficiently in advance of Work to permit processing.
- G. Electronic Submittals:
 - 1. Make electronic submittals consisting of one color PDF of each document, Product Data Sheet, or Shop Drawing.
 - 2. Should full size hard copies of Submittals be required by District, Contractor, or Consultant, Architect will provide one marked-up color copy of PDF to Owner, Contractor, or Consultant for their use in printing additional copies.
 - 3. Architect will review and return marked-up PDFs to Contractor.
 - 4. Mark-up one copy of each PDF and maintain as "Record Document".
- H. Material Safety Data Sheets/Safety Data Sheets (MSDS/SDS):
 - 1. Do not include MSDS/SDS in submittals to Architect.
 - a. MSDS/SDS sheets will not be reviewed by Architect and will not be returned.
 - 2. Include MSDS/SDS sheets in submittals to Contractor only.

1.03 PRODUCT DATA

- A. Collect Product Data into single submittal for each element of construction or system.
- B. Product Data includes standard printed information on manufactured products that has not been specially prepared for this Project, including, but not necessarily limited to following items:
 - 1. Manufacturer's product specifications and installation instructions.
 - 2. Catalog cuts.
 - 3. Standard color charts.
 - 4. Roughing-in diagrams and templates.
 - 5. Standard wiring diagrams.
 - 6. Printed performance curves.
 - 7. Operational range diagrams.
 - 8. Mill reports.
 - 9. Standard product operating and maintenance manuals.
- C. Modify standard data sheets and drawings to delete information which is not applicable to Project.
 - 1. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as shop drawings.
 - a. Mark each copy to show applicable choices and options.
 - b. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate applicable information.
 - c. Include following information:
 - 1) Manufacturer's printed recommendations.
 - 2) Compliance with recognized trade association standards.
 - 3) Compliance with recognized testing agency standards.
 - 4) Application of testing agency labels and seals.
 - 5) Notation of dimensions and clearances required and as verified by Field measurement.
 - 6) Notation of coordination requirements.
- D. Supplement standard information to provide additional information specifically applicable to Project:
 - 1. Clearly mark each copy to show applicable choices and options and identify pertinent materials, products, or models.
 - 2. Show dimensions and clearances required.
 - 3. Show performance characteristics and capacities.
 - 4. Show wiring or piping diagrams and controls.
- E. Do not submit Product Data until compliance with requirements of Contract Documents has been confirmed.
 - 1. Unless noncompliance with Contract Document provisions is observed, submittal may serve as final submittal.
- F. Submittals:
 - 1. Make electronic submittals as specified in "General Submittal Procedures and Requirements" Article.

- G. Distribution:
 - 1. Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities.
 - a. Show distribution on transmittal forms.
 - 2. Do not proceed with installation until applicable copy of Product Data is in installer's possession.
- H. Do not permit use of unmarked copies of Product Data in connection with construction.

1.04 SHOP DRAWINGS

- A. Shop drawings are technical drawings and data that have been specially prepared for Project, including but not necessarily limited to following items:
 - 1. Prepared information, drawn to accurate scale.
 - 2. Fabrication and installation drawings.
 - 3. Shopwork manufacturing instructions.
 - 4. Setting diagrams.
 - 5. Templates.
 - 6. Patterns.
 - 7. Coordination drawings (for use on Project Site).
 - 8. Schedules.
 - 9. Design mix formulas.
 - 10. Contractor's engineering calculations.
- B. Include following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
 - 6. Sheet Size:
 - a. Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 inch by 11 inch but no larger than 30 inch by 42 inch.
- C. Highlight, encircle, or otherwise indicate deviations from Contract Documents.
- D. Standard information prepared without specific reference to Project is not considered Shop Drawings.
- E. Submittals:
 - 1. Make electronic submittals as specified in "General Submittal Procedures" Article.
- F. Do not use Shop Drawings without appropriate final stamp indicating action taken in connection with construction.
- G. Do not reproduce Contract Documents or copy standard information as basis of Shop Drawings.

1.05 SAMPLES

- A. Samples are physical examples of Work, including, but not limited to, following items:
 - 1. Partial sections of manufactured or fabricated work
 - 2. Small cuts or containers of materials.
 - 3. Complete units of repetitively- used materials.
 - 4. Swatches showing color, texture and pattern.
 - 5. Color Range Sets.
 - 6. Units of Work to be used for independent inspection and testing.
- B. Office Samples:
 - 1. Sufficient size and quantity to clearly illustrate:
 - a. Functional characteristics of product or material, with integrally related parts and attachment devices.
 - b. Full range of color, texture and pattern.
 - 2. Where size and quantity are not specified, provide minimum of four samples, 12 inches by 12 inches, minimum size, where samples are required
- C. Field Samples and Mock-Ups:
 - 1. Erect at Project Site in location acceptable to Architect.
 - 2. Construct each sample or mock-up complete, including Work of trades required in finished Work.
 - 3. Size of area as specified in respective specification section.
 - 4. Remove mock-ups at conclusion of Work or when acceptable to Architect.

1.06 VERIFIED REPORTS

- A. Submit Verified Reports to Division of State Architect (DSA). Comply with California Code of Regulations, Title 24, Part 1, Sections 4-336 and 4-343.

1.07 MISCELLANEOUS SUBMITTALS – WORK RELATED

- A. Including, but not necessarily limited to, following types of submittals:
 - 1. Specially prepared warranties/guarantees.
 - 2. Standard printed warranties.
 - 3. Maintenance agreements.
 - 4. Printed industry standards.
 - 5. Collected and bound operating/maintenance manuals.
 - 6. Keying schedule, keys, and other security protection safety devices.
 - 7. Maintenance tools and spare parts.

1.08 CONTRACTOR RESPONSIBILITIES

- A. As defined in Division 00 General Conditions and following:
 - 1. Review shop drawings, product data and samples prior to submission to Architect.
 - 2. Determine and Verify:
 - a. Field measurements.
 - b. Field construction criteria.
 - c. Catalog numbers and similar data.
 - d. Conformance with specifications.
 - 3. Coordinate each submittal with requirements of Work and of Contract documents.

4. Notify Architect in writing, at time of submission, of deviations in submittals from requirements of Contract Documents
5. Do not begin fabrication of Work that requires submittals until return of submittals with Architect approval.

1.09 RESUBMITTAL REQUIREMENTS

- A. Shop Drawings:
 1. Revise initial drawings as required and resubmit as specified for initial submittal.
 2. Indicate on drawings changes that have been made other than those requested by Architect.
- B. Product Data and Samples:
 1. New data and samples, same as required for initial submittal.

1.10 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

- A. Distribute reproductions of Shop Drawings and copies of Product Data which carry Architect/Engineer stamp to:
 1. Project Site file.
 2. Record Documents file.
 3. Other affected contractors.
 4. Subcontractors.
 5. Supplier or Fabricator.
 6. Owner's Project Inspector.
- B. Distribute samples that carry Architect's review stamps as directed by Architect.

1.11 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, Architect will review each submittal, mark to indicate action taken, and return promptly.
 1. Compliance with specified characteristics is Contractor's responsibility.
- B. Action Stamp:
 1. Architect will stamp each submittal with uniform, self-explanatory action stamp.
 2. Stamp will be appropriately marked, as follows, to indicate action taken:
 - a. Final Unrestricted Release:
 - 1) Where submittals are marked "No Exception Taken", that part of Work covered by submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 - b. Final-But-Restricted Release:
 - 1) When submittals are marked "Make Correction Noted", that part of Work covered by submittal may proceed provided it complies with notations or corrections on submittal and requirements of Contract Documents.
 - 2) Final acceptance will depend on that compliance.

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- c. Returned for Re-submittal:
- a. When submittal is marked "Revise and Resubmit", do not proceed with that part of Work covered by submittal, **including** purchasing, fabrication, delivery, or other activity.
 - 1) Revise or prepare new submittal in accordance with notations.
 - 2) Resubmit without delay.
 - 3) Repeat if necessary to obtain different action mark.
 - 4) Do not permit submittals marked "Rejected" or "Revise and Resubmit" to be used at Project Site, or elsewhere where Work is in progress.
- d. Other Action:
 - 1) Where submittal is primarily for information or record purposes, special processing or other activity, submittal will be returned, marked "Action Not Required".

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 3300

SECTION 01 4100

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
1. General regulatory requirements pertaining to Work supplementary to other regulatory requirements mentioned or referenced elsewhere in Contract Documents.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

- A. Pertaining statutes, ordinances, laws, rules, codes, regulations, standards, and lawful orders of public authorities having jurisdiction of Work are incorporated into these Contract Documents same as if repeated in full, and as such are intended where reference is made in either singular or plural to Code or Building Code unless otherwise specified including, without limitation, those in list below.
1. Make available at Project Site such copies of listed documents applicable to Work as Architect or Owner may request including mentioned portions of California Code of Regulations (CCR).
- B. Project is fully governed under State of California's Codes Section Group 1, Chapter 4, Part 1, CCR, Title 24, as it pertains to school construction:
1. Inspector and Continuous Inspections of Work:
 - a. Per Sections 4-333(b) and 4-342.
 2. Tests and Testing Laboratory:
 - a. Per Section 4-335.
 - b. Owner pays for testing laboratory.
 3. Special Inspections:
 - a. Per Section 4-333(c).
 4. Verified Reports:
 - a. Submit per Sections 4-336 and 4-343(c).
 5. Administration:
 - a. Duties of Architect and Engineers:
 - 1) Per Sections 4-333(a) and 4-341.
 - b. Duties of Contractor:
 - 1) Per Section 4-343.
 - c. Verified Reports:
 - 1) Per Section 4-336.
 6. Arrange for copies of CCR, Title 24, Part 1, Part 2 Volumes 1 and 2, Part 3, and Part 9, to be made available during construction.
- C. Public regulatory requirements: Statutes, ordinances, laws, rules, codes, regulations, and standards include, but are not necessarily limited to, following:
1. California Code of Regulations (CCR):
 - a. Title 19 - Public Safety, current edition.
 - b. Title 24, Part 1 – 2019 California Administrative Code
 - c. Title 24, Part 2 – 2019 California Building Code (CBC), Volumes 1 and 2.
 - d. Title 24, Part 3 – 2019 California Electrical Code (CEC).

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- e. Title 24, Part 4 – 2019 California Mechanical Code (CMC)
 - f. Title 24, Part 5 – 2019 California Plumbing Code (CPC).
 - g. Title 24, Part 6 – 2019 California Energy Code
 - h. Title 24, Part 9 – 2019 California Fire Code (CFC).
 - i. Title 24, Part 10 – 2019 California Existing Building Code (CEBC):
 - 1) Includes Parts 8 and 12:
 - a) Part 8 – California Historical Building Code (CHBC)
 - b) Part 12 – California Referenced Standards Code (CRSC)
 - j. Title 24, Part 11 – 2019 California Green Building Standards Code (GBSC)
2. Other statutes, ordinances, laws, regulations, rules, orders, and codes specified in other Sections of Specifications or bearing on Work.

1.03 GOVERNING REGULATIONS/AUTHORITIES

- A. Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents
- 1. Information may or may not be of significance to Contractor.
 - 2. Owner and Architect, at request of Contractor, are to contact authorities having jurisdiction directly for information and decisions having bearing on Work.

1.04 SUBMITTALS

- A. Permits, Licenses, and Certificates:
- 1. Submit for Owner's records, copies of following, including but not necessarily limited to:
 - 2. Permits
 - 3. Licenses
 - 4. Certifications
 - 5. Inspection reports
 - 6. Releases
 - 7. Jurisdictional settlements
 - 8. Notices
 - 9. Receipts for fee payments
 - 10. Judgments, and similar documents
 - 11. Correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of Work.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 4100

SECTION 01 4200

REFERENCES

PART 1 GENERAL

1.01 DEFINITIONS

- A. Basic contract definitions are included in Division 00 General Conditions.
- B. Indicated:
 - 1. Refers to graphic representations, notes or schedules on Drawings, or other paragraphs or schedules in Specifications, and similar requirements in Contract Documents.
 - 2. Where terms such as “shown”, “noted”, “scheduled”, and “specified” are used, it is to help locate the reference
 - a. No limitation of location is intended except as specifically noted.
- C. Directed:
 - 1. Terms such as “directed”, “requested”, “authorized”, “selected”, “approved”, “required”, and “permitted” mean “directed by Architect”, “requested by Architect”, and similar phrases.
 - 2. No implied meaning is to be interpreted to extend Architect’s responsibility into Contractor’s area of construction supervision.
- D. Approved:
 - 1. Where used in conjunction with Architect’s action on Contractor’s submittals, applications, and requests, is limited to Architect’s duties and responsibilities as stated in General Conditions.
- E. Regulations:
 - 1. Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within construction industry that control performance of Work.
- F. Furnish:
 - 1. Means supply and deliver to Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. Install:
 - 1. Describes operations at Project Site including actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning, and similar operations.
- H. Provide:
 - 1. Means furnish and install, complete and ready for intended use.
- I. Installer:
 - 1. Contractor or entity engaged by Contractor, either as employee, subcontractor, or sub-subcontractor, for performance of particular construction activity, including installation, erection, application, and similar operations.

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2. Installers are required to be experienced in operations they are engaged to perform.
- J. Project Site:
1. Space available to Contractor for performance of construction activities, either exclusively or in conjunction with others performing other construction activities as part of Project.
 2. Extent of Project Site is shown on Drawings and may or may not be identical with description of land upon which Project is to be built.
- K. Testing Laboratories:
1. Independent entity engaged to perform specific inspections or tests, either at Project Site or elsewhere, and to report on and, when required, to interpret results of those inspections or tests.

1.02 INDUSTRY STANDARDS

- A. Applicability of Standards:
1. Except where Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents.
 - a. Such standards are made part of Contract Documents by reference.
 2. Individual Sections indicate which codes and standards Contractor must make available at Project Site for reference.
- B. Publication Dates:
1. Comply with standard in effect as of date of Contract Documents.
- C. Copies of Standards:
1. Each entity engaged in construction on Project is required to be familiar with industry standards.
 2. Applicable standards are not bound with Contract Documents.
 3. Where copies of standards are required by individual specification sections or are needed for performance of required construction activity, obtain copies directly from publication source.
- D. Conflicting Requirements:
1. Where compliance with two or more standards is specified, and standards establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to Architect for decision before proceeding.

1.03 GOVERNING REGULATIONS/AUTHORITIES

- A. Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents
1. That information may or may not be of significance to Contractor.
 2. Owner and Architect, at request of Contractor, are to contact authorities having jurisdiction directly for information and decisions having bearing on Work.

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PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 4200

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SECTION 01 4500

QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements for quality control services.
 - 2. Quality control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities.
 - a. They do not include contract enforcement activities performed by Architect.
 - 3. Inspection and testing services are required to verify compliance with requirements specified or indicated.
 - a. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
 - 4. Requirements for Contractor to provide quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
- C. Related Requirements Specified Elsewhere:
 - 1. Inspections and testing required by laws, ordinances, rules, regulations or orders of public authorities: General Conditions.
 - 2. Certification of Products:
 - a. Respective specification sections.
 - 3. Test, Adjust and Balance of Equipment:
 - a. Respective specification sections.
 - 4. Tests and Standards:
 - a. Each specification section listed.

1.02 SELECTION OF TESTING AGENCY

- A. Owner will select and employ consultant, testing laboratory or inspection agency to perform specified services.
- B. Employment of Testing Laboratory in no way relieves Contractor of his obligation to perform Work in accord with Contract.

1.03 PROJECT INSPECTOR

- A. Owner will select and employ Project Inspector, approved by DSA.

1.04 PAYMENT

- A. Costs of quality control services will be initially paid for by Owner. following quality control services, chargeable to Contractor, will be reimbursed to Owner by deductive change order:
 - 1. Batch Plant Inspection.
 - 2. Taking and testing cores from concrete.
 - 3. Testing of reinforcing steel test specimens.

1.05 DEFICIENCIES

- A. Cost of tests or inspections due to following will be reimbursed to Owner by deductive change order.
 - 1. Retesting because of failure of initial samples.
 - 2. Additional costs due to overtime work or extra shifts work because of improper scheduling of Work or of delivery of materials by Contractor.
 - 3. Failure to properly notify laboratory.
 - 4. Changes in sources, lots or suppliers of materials after original tests.
 - 5. Changes in methods or materials of construction requested by Contractor that require testing, inspection, or other related services in excess of that required by original design.
 - 6. Concrete mix designs in excess of first successful design for each concrete type.
 - 7. Overtime or extra shift work requiring overtime work by Owner's Inspector.

1.06 TESTS AND INSPECTION

- A. Testing laboratory or Owner's Project Inspector, and not Contractor, will make selection of material required to be tested.
- B. Notify Owner's Project Inspector in sufficient time in advance of manufacture of material to be supplied by him under Contract Documents, which must, by terms of Contract be tested, in order that Owner may arrange for testing of same at source of supply.
- C. Do not incorporate into Project, material shipped by Contractor from source of supply prior to having satisfactorily passed such testing and inspection or prior to receipt of notice from Project Inspector that such testing and inspection will not be required.

1.07 TESTING AGENCY SERVICES

- A. Cooperate with Architect and Contractor
 - 1. Provide qualified personnel promptly on notice.
- B. Perform specified inspections, sampling and testing of materials and methods of construction:
 - 1. Comply with specified standards; ASTM, other recognized authorities, and as specified.
 - 2. Ascertain compliance with requirements of Contract Documents.
- C. Attend pre-construction conference and progress meetings when requested by Architect or Owner.

- D. Perform additional services as required by Owner.
- E. Submittals:
 - 1. Promptly submit copies of reports of inspections and tests, mill analysis, concrete mix designs and certifications per applicable sections of specification.
 - 2. Submit one copy of test reports to:
 - a. Owner.
 - b. Architect.
 - c. Contractor.
 - d. Project Inspector.
 - 3. Include tests made, regardless of whether such tests indicate that material is satisfactory or unsatisfactory.
 - 4. Report samples taken but not tested.
 - 5. Report records of special sampling operations as required.
 - 6. Show in report that material or materials were sampled and tested in accordance with requirements of Title 24 and with approved specifications.
 - 7. Show specified design strength in test reports.
 - a. State definitely in test reports whether or not material or materials tested comply with requirements.
- F. Report Data:
 - 1. Written reports of each inspection, test, or similar service include, but are not limited to, following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making inspection or test.
 - f. Designation of Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and interpretation of test results.
 - j. Ambient conditions at time of sample taking and testing.
 - k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.
- G. Testing Agency is not authorized to:
 - 1. Release, revoke, alter, or enlarge requirements of Contract Documents or approve or accept portions of Work.
 - 2. Perform duties of Contractor.

1.08 INSPECTION BY OWNER AND PROJECT INSPECTOR

- A. Provide full access to Owner and his Project Inspector for purpose of inspection of parts of Work and to shops wherein Work is in preparation
 - 1. Maintain proper facilities and provide safe access for such inspection.

1.09 INSPECTION BY OWNER

- A. Owner retains right to reject materials and workmanship which are defective, or to require their correction.

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1. Satisfactorily correct rejected workmanship and remove rejected materials from premises without charge to Owner.
 2. When Contractor does not correct such rejected work within reasonable time, fixed by written notice, Owner may correct same and charge expense to Contractor.
- B. Should it be considered necessary or advisable by Owner at or before final acceptance of entire Work to make examination of Work already completed by removing or tearing out same, upon request, promptly furnish necessary facilities, labor, and materials.
1. When such Work is found to be defective due to fault of Contractor or his subcontractor, defray expenses of such examinations and of satisfactory reconstruction.
 2. Should such Work be found to meet requirements of Contract, Contractor will be allowed additional cost of labor and material necessarily involved in examination and replacement.

1.10 WORK BY OWNER'S PROJECT INSPECTOR

- A. Owner's Project Inspector will perform following tests and inspections:
1. Concrete slump tests.
 2. Concrete cylinder samples.
 3. Continuous inspection of masonry work.
 4. Mortar and grout prisms.
 5. Special Inspections for Welding.

1.11 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested .
- B. Provide to agency, selected preliminary representative samples of materials to be tested, in required quantities or assist agency in taking samples.
- C. Furnish incidental labor and facilities:
1. To provide access to Work.
 2. To obtain and handle samples at Site.
 3. To facilitate inspections and tests.
 4. For agency's exclusive use for storage and curing of test samples.
 5. To provide security and protection of samples and test equipment at Project Site.
- D. Notify testing agency sufficiently in advance of operations to permit assignment of personnel and scheduling of tests.
- E. Coordination:
1. Coordinate sequence of activities to accommodate required services with minimum of delay.
 2. Coordinate activities to avoid necessity of removing and replacing construction to accommodate inspections and tests.
 3. Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.12 MISCELLANEOUS TESTS AND INSPECTIONS

- A. Soil and Compaction Testing and Inspection:
 - 1. Performed by Project Geotechnical (Soils) Engineer employed and paid by Owner.
- B. Special Tests:
 - 1. Special tests requested by Owner or Architect or DSA will be paid for by Owner, except that when such tests fail, deduct costs from Contract Price by Change Order.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

- A. Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of assignment of responsibility for inspection, testing, or similar services.

3.02 SCHEDULE OF TESTS, INSPECTIONS, AND METHODS

- A. References:
 - 1. Chapters and Articles refer to California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
 - 2. American Concrete Institute (ACI):
 - a. ACI 318 – Building Code Requirements for Structural Concrete and Commentary, current edition.
- B. Required Tests and Inspections:
 - 1. Following Tests and Inspections are required, as set forth in California Building Code and ACI 318, as referenced. :
- C. Excavations, Foundations and Retaining Walls (Chapter 18A):
 - 1. Site Grading: 1803A.4
 - 2. Compacted Fill Material: 1803A.6
- D. Inspection (Chapter 17A):
 - 1. Site Soil and Backfill: 1705A.6 – Table 1705A.6
- E. Concrete (Chapters 17A and 19A):
 - 1. Materials:
 - a. Portland Cement: 1705A.3.2; 1910A.1
 - b. Concrete Aggregates: 1705A.3.2; 1903A.5
 - c. Reinforcing Bars: 1705A.3.2; 1910A.2

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2. Quality:
 - a. Proportions of Concrete: 1705A.3 – Table 1705A.3, Item 5; 1910A.1, and ACI 318 – Section 26.4.3
 - b. Strength Tests of Concrete: 1705A.3 – Table 1705A.3, Item 6; 1905A.1.16; and ACI 318 – Section 26.12 as modified.
 - c. Mixing: 1903A, 1904A
 - d. Placing Record: 1705A.3.6
 3. Inspection:
 - a. Job Site: ACI 318 – Sections 26.5.1, 26.5.2.1 (A) and (B), 26.6.1.2 (D), 26.11.1.1 (A)
 - b. Batch Plant: 1705A.3.3
 - c. Waiver of Batch Plant: 1705A.3.3.1
 - d. Preplacement and Placing 1705A.3.5; 1705A.3.6
 - e. Post Installed Anchors: 1705A.3 – Table 1705A.3, Items 4a and 4b; 1910A.5 b.
 - f. Reinforcing Bar Welding: 1705A.3.1 – Table 1705A.3, Item 2, Table 1705A.2.1, Item 5b, 1903A.8
- F. Masonry (Chapters 16A, 17A, and 21A):
1. Materials:
 - a. Masonry Units: 2103A.1
 - b. Portland Cement, Lime: 2103A
 - c. Mortar and Grout Aggregates: 2103A.2; 2103A.3
 - d. Aggregates: 2103A.3.1
 - e. Reinforcing Bars: 2103A.4
 2. Quality:
 - a. Portland Cement Tests: 1910A.1
 - b. Mortar and Grout Tests: 2105A.3
 - c. Masonry Prism Tests: 2105A.2
 - d. Masonry Core Tests: 2105A.4
 - e. Masonry Unit Tests: 1705A.4; 2105A.2; 2105A.3
 - f. Reinforcing Bar Tests: 1910A.2
 3. Inspection:
 - a. Reinforced Masonry: 1705A.4
 - b. Reinforcing Bar Welding: 1705A.3.1 – Table 1705A.3, Item 2; Table 1705A.2.1, Item 5b; 1903A.8
 - c. Post Installed Anchors in Masonry: 1705A.4, Table 1705A.3, Items 4a and 4b; 1616A.1.19; 1910A.5
- G. Structural Steel (Chapters 17A and 22A):
1. Materials:
 - a. Structural Steel: 2205A.1
 - b. Identification: 2203A.1
 2. Quality:
 - a. Tests of Structural and Cold Formed Steel: 2211A.1.
 - b. Tests of High Strength Bolts, Nuts, Washers: 2213A.1
 - c. Tests of End Welded Studs: 2213A.2
 - d. Non-Destructive Weld Tests: 1705A.2.1

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3. Inspection:
 - a. Shop Fabrication: 1704A.2.5, 1705A.2
 - b. Welding: 1705A.2.1
 - c. High Strength Bolt Installation: 1705A.2.1, Table 1705A.2.1

END OF SECTION 01 4500

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SECTION 01 4525

CONCRETE MOISTURE TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Calcium Chloride and Relative Humidity tests for determining moisture in concrete slabs:
 - a. Calcium Chloride Test: Provide concrete moisture vapor emission and pH testing to concrete specified to be covered with floor coverings.
 - b. Relative Humidity Test: Provide in-situ concrete relative humidity and surface pH testing to concrete specified to be covered with floor coverings
 - c. Include concrete placed below, on and above grade.
 - d. Perform testing after allowing concrete to dry for minimum of 90 days.
 - 2. Schedule testing not less than 1 week, nor more than 3 weeks prior to scheduled flooring installation.
 - 3. Always perform both tests, prior to application of moisture mitigation systems
- B. Related Sections:
 - 1. Section 01 3300: Submittals; reports of test results.
 - 2. Section 03 3000: Cast-in-Place Concrete; under-slab vapor retarder and concrete floor sealer.
 - 3. Section 09 0562: Moisture Vapor Emission Control System

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM F 710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 2. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 3. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.

1.03 SUBMITTALS

- A. Reports:
 - 1. Provide test results for concrete moisture vapor emission and pH testing of concrete in chart form listing test dates, start/stop times, start/stop weight, weight gain in grams, moisture vapor emission values, and pH levels
 - 2. Provide test results for concrete in-situ relative humidity and pH testing in chart form listing test dates, time, depth of test well, in-situ temperature, relative humidity, and pH levels
 - 3. List test locations on chart and show same on 8-1/2 by 11 inch site map
 - a. Make such map available to testing agency
 - 4. Deliver results to Owner, Owner's Project Inspector, Architect, Contractor, and flooring covering contractors.

1.04 QUALITY ASSURANCE

- A. Pre-Installation Meeting:
 - 1. Schedule meeting with Owner, Architect, Independent Testing Agency, and Construction Manager
 - a. Comply with requirements of Section 01 3119.
 - b. Arrange for attendance by floor covering installers and floor covering manufacturers' technical representatives.
 - 2. Meeting to include, but not limited to, following:
 - a. Review of calcium chloride, relative humidity, and pH test results on floor slabs.
 - b. Adhesive application instruction.
 - c. Scheduling and procedures for periodic field inspections by floor covering manufacturers' technical representatives.
 - 3. Record minutes of meeting and promptly distribute copies of minutes to attendees and other interested parties as may be necessary.
 - 4. Record issues resolved during meeting
 - a. Include copies of Drawings and application instructions used in meeting
 - b. Record changes on Drawings and application instructions made at meeting.
- B. Independent Testing Agency:
 - 1. Calcium Chloride Testing: Certified by Test Kit Manufacturer for product use.
 - 2. Relative Humidity Testing: Certified by Test Apparatus Manufacturer for product use.
 - 3. Other agency with verifiable experience
- C. Commercially Produced Moisture Vapor Emission Test Kits:
 - 1. Test dish including calcium chloride must be commercially packaged and delivered to test site in sealed factory wrapping
 - 2. Test dome from same source as dish.
 - 3. Test kit must comply with ASTM standards of size and weight.
- D. Digital Meter and Calibrated Humidity Probes:
 - 1. Minimum 2-point probe calibration
- E. Wide range pH paper, and distilled or de-ionized water.

PART 2 PRODUCTS

2.01 MOISTURE TESTING MATERIALS AND EQUIPMENT

- A. Calcium Chloride Test as manufactured by Vaprecision, Full Spectrum Flooring, or approved equal.
- B. Humidity and Temperature probe kit as manufactured by Vaisala, or approved equal.
- C. Wide range pH test paper as manufactured by Micro Essential Laboratory, or approved equal.

PART 3 EXECUTION

3.01 TESTING – GENERAL

- A. Maintain test site at same temperature and humidity conditions as those anticipated during normal occupancy.
 - 1. Maintain these temperature and humidity levels for 48 hours prior and during test period.
 - 2. When meeting this criteria is not possible, then minimum conditions should be 75 ± 10 degrees F and 50 ± 10 percent relative humidity.
 - 3. When building is not under HVAC control, place recording hygrometer or data logger to record conditions during test period.
 - a. Include transcript of this information with test report.

3.02 QUANTIFICATION OF CONCRETE MOISTURE VAPOR EMISSION

- A. Number of vapor emission test sites is determined by square footage of facility.
 - 1. Minimum number of tests to be placed is equal to 3 in first 1,000 square feet and 1 per each additional 1,000 square feet.
- B. Tests sites are to be cleaned of adhesive residue, curing compounds, paints, sealers, and floor coverings, 24 hours prior to placement of test kits.
- C. Weigh test dish at Project Site prior to start of test.
 - 1. Scale must report weight to 0.1 grams.
 - 2. Record weight and start time.
- D. Expose Calcium Chloride and set dish on concrete surface.
- E. Install test containment dome and allow test to proceed for 60 - 72 hours.
- F. Retrieve test dish by carefully cutting through containment dome.
 - 1. Close and reseal test dish.
- G. Weigh test dish on Project Site recording weight and stop time.
- H. Calculate and report results as "pounds of emission per 1,000 square feet per 24 hours"

3.03 QUANTIFICATION OF RELATIVE HUMIDITY AT 40 PERCENT OF CONCRETE THICKNESS

- A. Number of in-situ relative humidity test sites is determined by square footage of facility.
 - 1. Minimum number of tests to be placed is equal to 3 in first 1,000 square feet and 1 per each additional 1,000 square feet.
- B. Determine thickness of concrete slab, typically from construction documents
- C. Utilizing roto-hammer, drill test holes to depth equal to 40 percent of concrete thickness.
 - 1. For example – 2 inches deep for 5 inch thick slab, or 1-1/2 inches deep for 4 inch thick slab.

2. Test elevated structural slab (not poured in pans) at depth equal to 20 percent of its thickness.
 3. Hole Diameter: Do not exceed outside diameter of insertable test sleeve by more than 0.04 inch.
 - a. Drilling operation must be dry.
- D. Vacuum concrete dust from test hole.
- E. Insert hole liner or sleeve to full depth of test hole, ensuring that liner is capped or plugged at end protruding from concrete surface.
- F. Permit test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
- G. Remove sleeve plug and place probe into sleeve ensuring that it reaches bottom of test hole.
 1. Test probe must be at temperature equilibration with concrete slab.
- H. Read and record temperature and relative humidity at test site.

3.04 QUANTIFYING pH LEVEL

- A. At each vapor emission test site, after removal of test containment dome, and at or near relative humidity test site, perform pH test.
1. Place several drops of water onto concrete surface to form puddle approximately 1 inch in diameter.
 2. Allow water to set for approximately 60 seconds
 3. Dip pH paper into water and remove immediately
 - a. Compare color to chart provided by paper supplier to determine pH reading
- B. Record and report results.

3.05 ADDITIONAL TESTING

- A. When more complete assessment of moisture content in concrete is necessary, perform relative humidity profiling.
- B. In lieu of limiting testing to single depth within slab, profiling includes testing at depths of 20 percent 40% and 60% of concrete thickness.
- C. This extended testing may be limited to groupings in each 2,000 or 5,000 square feet, with single depth testing at each 1,000 square feet increment as outlined above.

3.06 CLEANING

- A. Upon completion of testing, remove dust, debris, surplus materials and tools of Work from Project Site.
- B. Leave installation clean and ready for succeeding finishes.

END OF SECTION 01 4525

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Temporary facilities required for this Work include, but are not necessarily limited to:
 - a. Temporary utilities such as heat, water, electricity, and telephone.
 - b. Field offices and sheds
 - c. Sanitary facilities.
 - d. Construction aids.
 - e. Barriers.
 - f. Temporary controls.
 - g. Temporary tree and plant protection
 - h. Temporary informational signs.
- B. Related Sections:
 - 1. Section 01 5713: Temporary Erosion and Sedimentation Controls
 - 2. Section 32 1000: Site Clearing
- C. Related Requirements:
 - 1. Refer to District's Division 00 Documents, including General Conditions, and other Division 01 Sections, for additional requirements.
 - 2. Refer to Division 32 Sections for additional traffic control requirements.
 - 3. Permanent installation and hook-up of various utility lines are described in other pertinent sections.
 - 4. Comply with requirements of pertinent safety regulations for equipment furnished by subcontractors.
- D. Work Not Part of This Section:
 - 1. Ladders, planks, hoists, and similar items normally furnished by individual trades in execution of their own portions of Work.

1.02 PROJECT CONDITIONS

- A. Use means necessary to maintain temporary facilities in proper and safe condition throughout progress of Work.

PART 2 PRODUCTS

2.01 UTILITIES

- A. Water:
 - 1. Provide necessary temporary water lines and water supply and upon completion of Work, remove such temporary facility.
 - 2. Provide and pay for water needed for construction.

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- B. Electricity:
 - 1. Provide necessary temporary wiring and upon completion of Work, remove such temporary facility.
 - 2. Provide area distribution boxes so located that individual trades may furnish and use 100 foot maximum length extension cords to obtain adequate power and artificial lighting at points where needed for work, inspection, and safety.
 - 3. Provide and pay for electricity needed for construction.
- C. Heating:
 - 1. Provide and maintain heat necessary for proper conduct of operations needed in Work.
- D. Telephone:
 - 1. Make necessary arrangements and pay costs for installation and operation of telephone service to Contractor's office on Project Site and Owner's Project Inspector's office on Project Site.
 - 2. Install telephone on separate line for each temporary office.
 - a. Where office has more than one occupant, provide telephone for each additional occupant.
 - 3. Coin operated telephones are not acceptable.

2.02 FIELD OFFICES AND SHEDS

- A. Contractor's Facilities:
 - 1. Provide field office building and sheds adequate in size and accommodation for Contractor's offices, supply, and storage.
- B. Owner's Project Inspector's Office:
 - 1. Provide lockable office at least 10 feet by 12 feet in dimension with lockable operable window, serviceable finishes, lighting, heating, and air conditioning, for use by Owner's Project Inspector.
 - 2. Furnish with lockable desk, reference table, lockable 4 drawer file cabinet, plan rack, and two chairs.
 - 3. Subject to District approval, provide space in Contractor's Field Office for Owner's Project Inspector, in lieu of separate office.
- C. Provide and maintain on premises, where directed, watertight storage sheds for materials which might be damaged by weather, including storage facilities for concrete test samples or other material samples required for Work.

2.03 SANITARY FACILITIES

- A. Sanitary facilities include temporary toilets, wash facilities, and drinking water fixtures.
 - 1. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
 - 2. Install where facilities will best serve Project's needs.
 - 3. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility.
 - 4. Provide covered waste containers for used material.

- B. Temporary Toilet Units:
 - 1. Provide self-contained, single-occupant toilet units of chemical, aerated recirculation, or combustion type.
 - 2. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
 - 3. Provide separate facilities for male and female personnel.
 - 4. Maintain in sanitary condition.
- C. Wash Facilities:
 - 1. Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for healthy and sanitary condition.
 - 2. Dispose of drainage properly.
 - 3. Supply cleaning compounds appropriate for each condition.
 - 4. Provide safety showers, eyewash fountains , and similar facilities for convenience, safety, and sanitation of personnel.
- D. Drinking-Water Facilities:
 - 1. Provide containerized, tap-dispenser, bottled water drinking water units, including paper supply.

2.04 CONSTRUCTION AIDS

- A. Provide construction aids and equipment required by personnel and to facilitate execution of Work
 - 1. Scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.
- B. Provide necessary facilities and means of access to structure so that Building Inspectors, Special Inspectors, Architect and Structural Engineer may inspect structure or portions of structure as necessary.
 - 1. Means of access includes, but is not necessarily limited to, ladders, scaffolds, and similar items.

2.05 BARRIERS

- A. Temporary Fencing:
 - 1. Provide temporary fence around entire construction area as required for safety and protection.
 - 2. Construction:
 - a. Provide chain link fencing not less than six feet in height, complete with metal or wood posts and required bracing, and with suitably locked truck and pedestrian gates as required.
 - 3. Provide opaque, fabric or plastic windscreen material, full height and run of fencing, including gates.
- B. Tree and Plant Protection:
 - 1. Preserve and protect existing trees and plants at Project Site that are designated to remain, and those adjacent to Project Site.
 - 2. Provide temporary barriers around each, or around each group of trees or plants.

3. Trenching Near Trees:
 - a. Where utility trenches are required near trees, excavate under or around tree roots by hand or with air spade.
 - b. Do not cut main lateral tree roots or taproots.
 - 1) Cut only smaller roots that interfere with installation of utilities.
 - 2) Do not allow exposed roots to dry out before placing permanent backfill.

2.06 TEMPORARY CONTROLS

- A. Contractor Responsibility:
 1. Specific safety requirements by governmental authorities, including requirements of latest Occupational Safety and Health Act (OSHA) and Cal/OSHA.
- B. Provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at construction site and related areas under Contractor's control.
 1. Remove physical evidence of temporary facilities at completion of Work.
 2. Comply with requirements of authorities having jurisdiction.
- C. Dust Control:
 1. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and provide positive means to prevent airborne dust from dispersing into atmosphere.
- D. Water Control:
 1. Provide methods to control surface water to prevent damage to Project, Site, or adjoining properties.
 2. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas and to direct drainage to proper runoff.
 3. Provide, operate and maintain hydraulic equipment of adequate capacity to control surface water.
 4. Dispose of drainage water in manner to prevent flooding, erosion, or other damage to Project Site or to adjoining areas.
 5. Comply with requirements specified in Section 01 5713.
- E. Debris Control:
 1. Maintain areas under Contractor's control free of extraneous debris.
 2. Prevent accumulation of debris at construction site, storage and parking areas, or along access roads.
 3. Provide containers for deposit of debris as specified in Section 01 7419.
- F. Pollution Control:
 1. Provide methods, means and facilities required to prevent contamination of soil, water and atmosphere by discharge of noxious substances from construction operations.
 2. Provide equipment and personnel to perform emergency measures required to contain spillage, and to remove contaminated soils and liquids.
 3. Take special measures to prevent harmful substances from entering public waters.

- a. Prevent disposal of wastes, effluents, chemicals, and other such substances in sanitary or storm sewers.
- G. Temporary Fire Protection:
 - 1. Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses.
 - 2. Comply with NFPA 241 .
 - 3. Prohibit smoking in construction areas.
 - 4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 5. Develop and supervise overall fire prevention and protection program for personnel at Project Site.
 - a. Review needs with local fire department and establish procedures to be followed.
 - b. Instruct personnel in methods and procedures.
 - c. Post warnings and information.

2.07 TEMPORARY INFORMATIONAL SIGNS

- A. Provide temporary informational signs as follows:
 - 1. As required by codes, laws and regulatory agencies and to:
 - a. Inform public and persons seeking entrance to Project.
 - b. Identify key elements of construction facilities.
 - c. Direct traffic.
- B. Prepare temporary signs of sizes indicated.
 - 1. Erect on Project Site as approved by Architect.
 - 2. Support on posts or framing of preservative treated wood or steel.
 - 1. Do not permit installation of unauthorized signs..

2.08 OWNERSHIP OF TEMPORARY FACILITIES AND CONTROLS

- C. Items provided by Contractor under this Section remain property of Contractor
 - 1. Remove such items from job site immediately upon completion of Work..

PART 3 EXECUTION

3.01 MAINTENANCE AND REMOVAL

- A. Maintain temporary facilities as long as needed for safe and proper completion of Work.
- B. Remove such temporary facilities as rapidly as progress of Work will permit, or as directed by Architect.

END OF SECTION 01 5000

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SECTION 01 5713

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Prevention of erosion due to construction activities.
 - 2. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
 - 3. Restoration of areas eroded due to insufficient preventive measures.
 - 4. Performance Bond.
 - 5. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.
- B. Related Sections:
 - 1. Section 31 0000: Earthwork; temporary and permanent grade changes for erosion control.
 - 2. Section 31 1000: Site Clearing; limits on clearing; disposition of vegetative clearing debris.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM D 4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
- B. United States Environmental Protection Agency (EPA):
 - 1. National Pollutant Discharge Elimination System (NPDES):
 - a. Construction General Permit (CGP); current edition.
- C. Public Works Standards, Inc.:
 - 1. Standard Specifications for Public Works Construction (SSPWC):
 - a. The "Greenbook"; current edition.
 - 2. Standard Plans for Public Works Construction (SPPWC); current edition.
- D. California Stormwater Quality Association (CASQA):
 - 1. Best Management Practice (BMP) Handbook, current edition.

1.03 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of U.S. Environmental Protection Agency (EPA) for erosion and sedimentation control, as specified for National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for 2017 Construction General Permit (CGP).
- B. Comply with requirements of California State Construction General Permit Order 2009-0009-DWQ for erosion and sedimentation control, even though this Project is not required by law to comply.

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- C. Best Management Practices Standard:
 - 1. Federal Highway Administration Best Management Practices for Erosion and Sediment Control.
- D. Develop and follow Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained.
 - 1. Furnish documentation required to obtain applicable permits.
- F. Provide to Owner Performance Bond covering erosion and sedimentation preventive measures only, in amount equal to 100 percent of cost of erosion and sedimentation control work.
- G. Timing:
 - 1. Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- H. Storm Water Runoff:
 - 1. Control increased storm water runoff due to disturbance of surface cover due to construction activities for Project.
 - 2. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - 3. Anticipate runoff volume due to most extreme short term and 24-hour rainfall events that might occur in 25 years.
- I. Erosion On Site:
 - 1. Minimize wind, water, and vehicular erosion of soil on Project Site due to construction activities for Project.
 - 2. Control movement of sediment and soil from temporary stockpiles of soil.
 - 3. Prevent development of ruts due to equipment and vehicular traffic.
 - 4. When erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- J. Erosion Off Site:
 - 1. Prevent erosion of soil and deposition of sediment on other properties caused by water leaving Project Site due to construction activities for Project.
 - 2. Prevent windblown soil from leaving Project Site.
 - 3. Prevent tracking of mud onto public roads outside Project Site.
 - 4. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 5. When erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- K. Sedimentation of Waterways On Site:
 - 1. Prevent sedimentation of waterways on Project Site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 2. When sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 3. When sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

- L. Sedimentation of Waterways Off Site:
 - 1. Prevent sedimentation of waterways off Project Site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 2. When sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- M. Open Water:
 - 1. Prevent standing water that could become stagnant.
- N. Maintenance:
 - 1. Maintain temporary preventive measures until permanent measures have been established.

1.02 SUBMITTALS

- A. Erosion and Sedimentation Control Plan and Stormwater Pollution Prevention Plan (SWPPP):
 - 1. Include:
 - a. Site plan:
 - 1) Identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - 2) Showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - b. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - c. Schedule of temporary preventive measures, in relation to ground disturbing activities.
 - d. Other information required by law.
 - e. Format required by law is acceptable, provided additional information specified is also included.
 - 2. Obtain approval of Plan by authorities having jurisdiction.
 - 3. Obtain approval of Plan by Owner.
- B. Certificate:
 - 1. Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements.
 - a. Signed by legally authorized official of manufacturer.
 - b. Indicate actual minimum average roll values.
 - 2. Identify fabric by roll identification numbers.
- C. Inspection Reports:
 - 1. Report of each inspection.
 - 2. Identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Gravel:
 - 1. Conforming to Greenbook standard.
- B. Grass Seed for Temporary Cover:
 - 1. Select species appropriate to climate, planting season, and intended purpose.
 - 2. When same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Project Site and identify existing features that contribute to erosion resistance.
- B. Maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule Work so that soil surfaces are left exposed for minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In cases, where permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Stabilized Construction Entrances:
 - 1. Traffic-bearing aggregate surface conforming to BMP TC-1 requirements.
 - a. Width:
 - 1) As required – 20 feet, minimum.
 - b. Length:
 - 1) 50 feet minimum.
 - c. Provide at each construction entrance from public right-of-way.
 - d. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers:
 - 1. Made of silt fences or gravel bags.
 - 2. Provide linear sediment barriers as indicated on Drawings.
- D. Storm Drain Curb Inlet Sediment Trap:
 - 1. As detailed on Drawings.
- E. Storm Drain Drop Inlet Sediment Traps:
 - 1. As detailed on Drawings.

- F. Soil Stockpiles:
 - 1. Protect using one of following measures:
 - a. Cover with polyethylene film, secured by placing soil on outer edges.
 - b. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

3.04 INSTALLATION

- A. Stabilized Construction Entrances:
 - 1. Traffic-bearing aggregate surface conforming to BMP TC-1 requirements.
 - a. Excavate minimum of 6 inches.
 - b. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
 - c. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.
- B. Silt Fences:
 - 1. Conforming to BMP SE-1 requirements and following:
 - a. Store and handle fabric in accordance with ASTM D4873.
 - b. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
 - c. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
 - d. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
 - e. Install with top of fabric at nominal height and embedment as specified.
 - f. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
 - g. Wherever runoff will flow around end of barrier or over top, provide temporary splash pad or other outlet protection
 - 1) At such outlets in run of barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.
- C. Install gravel bags conforming to BMP SE-6 requirements.

3.05 MAINTENANCE

- A. As minimum, maintain BMPs as described in reference BMP Handbook.
- B. Inspect preventive measures weekly, within 24 hours after end of storm that produces 0.5 inches or more rainfall at Project Site, and daily during prolonged rainfall.
- C. Repair deficiencies immediately.
- D. Silt Fences:
 - 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 - 2. Remove silt deposits that exceed one-third of height of fence.

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- 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures weekly and relocate soil on Project Site.
- F. Place sediment in appropriate locations on Project Site
 - 1. Do not remove sediment from Project Site.

3.01 CLEANING

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Engineer.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 5713

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Following Administrative and Procedural Requirements:
 - a. Selection of products for use in Project
 - b. Product delivery, storage, and handling.
 - c. Manufacturers' standard warranties on products.
 - d. Special warranties.
 - e. Product substitutions.
- B. Related Sections:
 - 1. Section 01 4200: References; applicable industry standards for products specified.
 - 2. Section 01 7700: Closeout Procedures; submittal of warranties for contract closeout.
- C. Related Requirements:
 - 1. Refer to District's Division 00 Documents, including General Conditions, and other Division 01 Sections, for additional requirements.
 - 2. Specific requirements for warranties on products and installations specified to be warranted are included in appropriate Divisions 02 through 33 Sections.

1.02 DEFINITIONS

- A. Definitions used in this Article are not intended to change meaning of other terms used in Contract Documents, such as "specialties", "systems", "structure", "finishes", "accessories", and similar terms.
 - 1. Such terms are self-explanatory and have well recognized meanings in construction industry.
- B. Products:
 - 1. Items purchased for incorporating into Work, whether purchased for Project or taken from previously purchased stock.
 - 2. Term "product" includes terms "material," "equipment," and terms of similar intent.
 - 3. Named Products:
 - a. Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of Contract Documents.
 - 4. New Products:
 - a. Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise.
 - 1) Products salvaged or recycled from other projects are not considered new products.

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- C. Substitutions:
 - 1. Changes in products, materials, equipment, and methods of construction required by Contract Documents and proposed by Contractor
 - 2. Following are not considered substitutions:
 - a. Substitutions requested during bidding period, and accepted by written Addendum prior to opening of bids or award of Contract.
 - 3. Revisions to Contract Documents requested by Owner or Architect.
 - 4. Specified options of products and construction methods included in Contract Documents.
 - 5. Compliance with governing regulations and orders issued by governing authorities.
- D. Basis-of-Design Product Specification:
 - 1. Where specific manufacturer's product is named and accompanied by words "Basis-of-Design", including make or model number or other designation, to establish significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.
- E. Manufacturer's Warranty:
 - 1. Preprinted written warranty published by individual manufacturer for particular product and specifically endorsed by manufacturer to Owner.
- F. Special Warranty:
 - 1. Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.03 SUBMITTALS

- A. Product Listing Schedule:
 - 1. Prepare schedule showing products specified in tabular form acceptable to Architect to include:
 - a. Generic names of products required.
 - b. Manufacturer's name and proprietary product names for each item listed.
 - 2. Form:
 - a. Prepare Product Listing Schedule with information on each item tabulated under following column headings:
 - 1) Related Specification Section number.
 - 2) Generic name used in Contract Documents.
 - 3) Proprietary name, model number and similar designations.
 - 4) Manufacturer's name and address.
 - 5) Supplier's name and address.
 - 3. Completed Schedule:
 - a. Within fifteen days after date of commencement of Work submit four copies of completed Product Listing Schedule.
 - 1) Furnish written explanation for omissions of data, and for known variations from Contract requirements.

1.04 QUALITY ASSURANCE

- A. To fullest extent possible, provide products of same kind, from single source.

1.05 REQUESTS FOR SUBSTITUTIONS

- A. Requests for Substitutions received after award of Contract will be considered only in case of substantiated product unavailability, or other conditions beyond control of Contractor.
- B. Substitution Requests:
 - 1. Submit one electronic copy (PDF) of each request for consideration.
 - 2. Identify product or fabrication or installation method to be replaced.
 - 3. Include Specification Section number and title and Drawing numbers and titles.
 - a. Refer to Article 2.02, in this Section.
 - 4. Substitution Request Form:
 - a. Use form provided by Owner.
 - 1) In absence of Owner furnished form, use form included at end of this Section.
 - b. Other forms will not be accepted.
 - c. Requests received without properly completed substitution request form will be rejected without further review.
 - 5. Documentation:
 - a. Show compliance with specified requirements for substitutions and following, as applicable:
 - 1) Statement indicating why specified material or product cannot be provided.
 - a) Submit statement on official letterhead of Contractor, supplier, or manufacturer, signed by an officer of the Company.
 - b) Statement will be subject to independent verification by Architect.
 - 2) Product identification, including manufacturer's name and address.
 - 3) Coordination information, including list of changes or modifications needed to other parts of Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - 4) Detailed, side-by-side comparison of significant qualities including attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 5) Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - 6) Structural calculations, where applicable or requested, prepared and signed by registered Structural Engineer licensed in California.
 - 7) Samples, where applicable or requested.
 - 8) List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - 9) Material test reports from qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - 10) Research/evaluation reports evidencing compliance with building code in effect for Project, from model code organization acceptable to authorities having jurisdiction.
 - 11) Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for Work, including effect on overall Contract Time.

- a) When specified product or method of construction cannot be provided within Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - 12) Cost information, including proposal of change, when occurring, in Contract Sum.
 - a) When substitution request is made after award of Contract, for other than reasons stated, include in request, benefit to Owner, in form of cost reduction.
 - 13) Designation of availability of maintenance services, sources of replacement materials.
 - 14) Contractor's certification that proposed substitution complies with requirements in Contract Documents and is appropriate for applications indicated.
 - 15) Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- C. Basis-of-Design Product Specification Submittal:
- 1. Comply with requirements in Section 01 3300.
 - 2. Show compliance with requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products using means and methods that will prevent damage, deterioration and loss, including theft; comply with manufacturer's written instructions.
- 1. Schedule delivery to minimize long term storage at Project Site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
 - 3. Deliver products to Project Site in undamaged condition in manufacturer's original sealed container, or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
 - 4. Inspect products on delivery to ensure compliance with Contract Documents, and to ensure products are undamaged and properly protected.
 - 5. Store products in manner to facilitate inspection and measurement of quantity or counting of units.
 - 6. Store materials in manner that will not endanger Project structure.
 - 7. Store products subject to damage by elements under cover in weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 9. Protect stored products from damage.

1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections are in addition to, and run concurrent with, other warranties required by Contract Documents.
- 1. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.

- B. Special Warranties:
 - 1. Prepare written document that contains appropriate terms and identification, ready for execution.
 - a. Submit draft for approval before final execution.
 - 2. Manufacturer's Standard Form:
 - a. Modified to include Project-specific information and properly executed.
 - 3. Refer to Division 26 through 32 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time:
 - 1. Comply with requirements in Section 01 7700 and General Conditions.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

- A. General Product Requirements:
 - 1. Provide products that comply with Contract Documents, that are undamaged and, unless otherwise indicated, unused at time of installation.
 - 2. Provide products complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use and effect.
 - 3. Standard Products:
 - a. Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 4. Owner reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
 - 5. Where products are accompanied by term "as selected", Architect will make selection.
 - 6. Where products are accompanied by term "match sample", sample to be matched is Architect's.
 - 7. Descriptive, performance, and reference standard requirements in Specifications establish "salient characteristics" of products.
 - 8. Where products are specified by name and accompanied by term "or equal", or "or approved equal", or "or approved", comply with provisions in "Product Substitutions" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 - 1. Procedures for product selection include following:
 - a. Product:
 - 1) Where Specification paragraphs or subparagraphs titled "Product" name single product and manufacturer, provide product named.
 - 2) Substitutions may be considered, unless otherwise indicated.
 - b. Products:
 - 1) Where Specification paragraphs or subparagraphs titled "Products" introduce list of names of both products and manufacturers, provide one of products listed that complies with requirements.
 - 2) Products and manufacturers are listed alphabetically and do not indicate order of preference, unless otherwise indicated.

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- c. Manufacturer/Source:
 - 1) Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide product by manufacturer or from source named that complies with requirements.
 - 2) Substitutions may be considered, unless otherwise indicated.
 - d. Manufacturers:
 - 1) Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce list of manufacturers' names, provide product by one of manufacturers listed that complies with requirements.
 - 2) Where manufacturers are specified by name, accompanied by term "or equal", or "or approved equal" comply with provisions in "Product Substitutions" Article to obtain approval for use of an unnamed product.
 - e. Product Options:
 - 1) Where Specification paragraph titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on specific product or system, provide either specific product or system indicated or comparable product or system by another manufacturer.
 - 2) Comply with provisions in "Product Substitutions" Article to obtain approval for use of unnamed product.
- C. Basis-of-Design Products:
- 1. Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to list of manufacturers' names, provide either specified product or comparable product by one of other named manufacturers.
 - 2. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on product named.
 - 3. Comply with provisions in "Product Substitutions" Article to obtain approval for use of unnamed product.
 - 4. Substitutions may be considered.
- D. Visual Matching Specification:
- 1. Where Specifications require matching established sample, select product and manufacturer that complies with requirements and matches Architect's sample.
 - 2. Architect's decision will be final on whether proposed product matches satisfactorily.
 - 3. Where no product is available within specified category that matches satisfactorily and complies with other specified requirements, comply with provisions of Contract Documents on "substitutions" for selection of matching product.
- E. Visual Selection Specification:
- 1. Where Specifications include phrase "as selected from manufacturer's colors, patterns, textures" or similar phrase, select product and manufacturer that complies with other specified requirements.

2. Standard Range:
 - a. Where Specifications include phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 3. Full Range:
 - a. Where Specifications include phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
- F. Performance Specification Requirements:
1. Where Specifications require compliance with performance requirements, provide products that comply with requirements, and are recommended by manufacturer for application indicated.
 2. General overall performance of product is implied where product is specified for specific application.
 3. Manufacturer's recommendations may be contained in product literature, or by manufacturer's certification of performance.

2.02 PRODUCT SUBSTITUTIONS

- A. Timing:
1. Requests for Substitutions are restricted to before bid opening as stated in Instruction to Bidders.
 2. Requests received after that time may be considered or rejected at discretion of Architect.
 3. Architect will consider request for substitution after commencement of Work only when specified product or construction method cannot:
 - a. Be provided within Contract Time.
 - b. Receive necessary approvals.
 - c. Be provided in manner compatible with or coordinate with other materials.
 - d. Provide required warranty.
- B. Conditions:
1. Contractor's substitution request will be received and considered by Architect when following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action except to record noncompliance with these requirements
 - a. Burden of proof of merit of proposed substitution is upon proposer.
 - b. Extensive revisions to Contract Documents are not required.
 - c. Requested substitution is consistent with Contract Documents and will produce indicated results.
 - d. Request is timely, fully documented and properly submitted.
 - e. Request is directly related to "or equal" clause or similar language in Contract Documents.
 - 1) Specified product or construction method cannot be provided within Contract Time.
 - 2) Request will not be considered when product or method cannot be provided as result of failure to pursue Work promptly, failure to identify items requiring long lead times, or failure to coordinate activities properly.

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- f. Specified product or construction method cannot:
 - 1) Receive necessary approval by governing authority, and requested substitution can be approved.
 - 2) Be provided in manner that is compatible with other materials, and where Contractor certifies that requested substitution will overcome incompatibility.
 - 3) Be coordinated with other materials, and where Contractor certifies that requested substitution can be coordinated.
 - 4) Provide warranty required by Contract Documents and where Contractor certifies that requested substitution provide required warranty.
 - g. Substantial advantage is offered Owner, in cost, time, energy conservation, or other considerations of merit, after deducting additional responsibilities Owner must assume.
 - 1) Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner or separate Contractors, and similar considerations.
 - h. When requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of Work, is uniform and consistent, is compatible with other products, and is acceptable to contractors involved.
- C. Architects Action:
 - 1. When necessary, within one week of receipt of request for substitution, Architect will request additional information or documentation for evaluation of request for substitution.
 - 2. Within 2 weeks of receipt of request, or one week of receipt of additional information or documentation, whichever is later, Architect will notify Contractor of acceptance or rejection of requested substitution.
 - 3. Form of Acceptance: Change Order.
 - 4. Use product specified when Architect cannot make decision on use of proposed Substitution within time allocated.
 - 5. Architect will not be responsible for locating or securing information which is not included in substantiating data.
 - 6. Architect's decision of acceptance or rejection of requested substitution is final.
- D. Architect's cost for evaluating substitutions requested by Contractor, including making subsequent revisions to Drawings, Specifications and other resulting documentation, will be paid by Owner with reimbursement from Contractor by deductive change order.
- E. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data, or Samples that relate to construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.

PART 3 EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in applications indicated.
 - 1. Anchor each product securely in place, accurately located and aligned with other Work.
 - 2. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01 6000

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Substitution Request Form

Project: _____ Substitution Request Number: _____
To: _____ Date: _____
_____ A/E Project Number: _____
Re: _____ Contract For: _____

Specification Title: _____
Section: _____ Page: _____ Article/Paragraph: _____

Requested Substitution: _____
Manufacturer: _____ Address: _____ Phone No. _____
Trade Name: _____ Model No.: _____
Installer: _____ Address _____ Phone No.: _____

History: ☐ New Product ☐ 2-5 yrs. old ☐ 5-10 yrs. old ☐ More than 10 yrs. old
Differences between requested substitution and specified product: _____

Provide Point-by-Point Itemized Comparison of requested substitution with specified product data attached

REQUIRED BY A/E – Comply with Division 01 Specification Section 01 6000.

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____
Address: _____ Owner: _____
_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Benefit to Owner for accepting substitution: _____ (\$ _____)

Proposed substitution changes Contract Time: ☐ No ☐ Yes; Add/Deduct _____ days.

Supporting Data Attached (Comply with Division 01 Specification Section 01 6000):

☐ Product Data ☐ Drawings ☐ Tests ☐ Reports ☐ Samples ☐ _____

Undersigned Certifies:

- Requested substitution has been fully investigated and determined to be equal or superior in every respect to specified product.
 - Same warranty will be furnished for requested substitution as for specified product.
 - Same maintenance service and source of replacement parts, as applicable, is available.
 - Requested substitution will have no adverse affect on other trades, and will not affect or delay Progress Schedule.
 - Cost data as stated above is complete.
 - Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
 - Requested substitution does not affect dimensions and functional clearances.
 - Undersigned will make payment for changes to building design, Including architectural or engineering design, detailing, and construction costs caused by requested substitution.
-

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

ARCHITECT'S REVIEW AND ACTION

- ☐ Substitution Approved – Make submittals in accordance with Division 01 Specification Section 01 3300.
- ☐ Substitution Approved as Noted – Make submittals in accordance with Division 01 Specification Section 01 3300.
- ☐ Substitution Rejected – Use specified materials.
- ☐ Substitution Request Received Too Late – Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

SECTION 01 7123

FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Furnishing services of registered Civil Engineer or licensed Land Surveyor for engineering services required for Project.
 - 2. Survey work required in execution of Project.
 - 3. Civil, structural or other professional engineering services specified, or required to execute Contractor's construction methods.
 - 4. Coordination with testing laboratory and soils engineer.
 - 5. Contractor furnished assistance.
 - 6. Verification of conditions.
- B. Related Sections:
 - 1. Section 01 3300: Submittal Procedures
 - 2. Section 01 7700: Closeout Procedures.
- C. Related Requirements:
 - 1. Refer to District's Division 00 Documents, including General Conditions, for additional requirements.

1.02 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 3300 and following:
 - 1. Name and address of Surveyor or professional engineer to Architect, including changes as they may occur.
 - 2. Upon request of Architect, provide documentation to verify accuracy of field engineering work.
 - 3. Include certificate signed by registered Civil Engineer or Land Surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.
- B. Record Drawings:
 - 1. At Project completion, obtain and pay for CD's and Files of Project Plans.
 - a. Clearly indicate differences between original drawings and completed Work within specified tolerances.
 - 2. Show as-built locations by coordinates of utilities onsite with top of pipe elevations at major grade and alignment changes.
 - 3. Date, sign and certify completed record drawing transparencies as correct, by Licensed Surveyor or Civil Engineer.
 - 4. Comply with requirements of Section 01 7700.

1.03 QUALITY ASSURANCE

- A. Qualifications of Surveyor or Engineer:
 - 1. Engage registered Civil Engineer or licensed Land Surveyor acceptable to both Contractor and Owner who is qualified to perform land surveying.

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2. Prior to start of Work, furnish to Owner, name and license (or registration number) issued by State of California, Board of Registration for Professional Engineers and Land Surveyors.
 3. Provide notice to Owner during course of construction should identification of individual responsible for this Work change, and obtain approval of Owner for replacement.
- B. Perform Field Engineering Services furnished during course of this Project under direct supervision and control of named individual civil engineer or land surveyor.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 SURVEY REFERENCE POINTS

- A. Existing horizontal and vertical control points for Project are those designated on Drawings.
- B. Locate and protect control points prior to starting site work, and preserve permanent reference points during construction.
1. Make no changes or relocations without prior written notice to Architect.
 2. Report to Architect when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 3. Identify and protect survey monuments on Project Site discovered during construction, which are not referenced on Project Drawings.
 - a. Tie out such monuments and notify Architect prior to allowing them to be disturbed.
 4. Replace permanent boundary markers disturbed during construction with new permanent monuments and file required Record of Survey or Corner Record in accordance with applicable State and County laws, at no additional cost to Owner.

3.02 PROJECT SURVEY REQUIREMENTS

- A. Establish minimum of two permanent horizontal and vertical control points on Project Site, remote from building area referenced to data established by survey control points.
1. Record locations, with horizontal and vertical data, on Project Record Documents, including description of monuments in place.
- B. Establish lines and levels, locations and dimensions, by instrumentation or similar technical appropriate means:
1. Site Improvements:
 - a. Utility lines, including, but not necessarily limited to, storm drains, sewers, water mains, gas, electric and telephone lines.
 - b. Provide adequate horizontal control to locate lines and provide vertical control in proportion to slope of line as required for accurate construction.
 2. Building Lines and Levels:
 - a. Furnish building corner offsets as required to adequately locate buildings.
 3. Provide control lines and levels required for Mechanical and Electrical work.
 4. Provide grade stakes and elevations as required to construct paved areas, landscaped areas, and other areas as required.

- a. Calculate and layout subgrade elevations and intermediate controls as required to provide smooth transitions between the spot elevations indicated on plans.
 - b. From time to time, verify layout of Work by same methods.
- 5. Provide batter boards or other similar control for drainage, utility, and other onsite structures as required.

3.03 RECORDS

- A. Maintain complete, accurate surveyor's log of control and survey work as it progresses.
 - 1. Make this log available for reference.

END OF SECTION 01 7123

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SECTION 01 7329

CUTTING AND PATCHING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Administrative and procedural requirements for cutting and patching.
- B. Related Sections:
 - 1. Section 01 1100: Summary of Work
 - 2. Section 01 7419: Construction Waste Management and Disposal
 - 3. Section 01 7423: Cleaning
- C. Related Requirements:
 - 1. Refer to Divisions 22 and 23 Sections for cutting, patching, of plumbing and mechanical items.
 - 2. Refer to Divisions 26, 27, and 28 Sections for cutting, patching, of electrical and related systems.

1.02 QUALITY ASSURANCE

- A. Requirements for Structural Work:
 - 1. Do not cut and patch structural elements in manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Operational and Safety Limitations:
 - 1. Do not cut and patch operating elements or safety related components in manner that would result in reducing their capacity to perform as intended or result in increased maintenance or decreased operational life or safety.
 - 2. Obtain approval before cutting and patching following operating elements or safety related systems:
 - a. Shoring, bracing, and sheeting.
 - b. Primary operational systems and equipment.
 - c. Water, moisture, or vapor barriers.
 - d. Membranes and flashings.
 - e. Fire protection systems.
 - f. Control systems.
 - g. Communication systems.
 - h. Electrical wiring systems.
- C. Visual Requirements:
 - 1. Do not cut and patch construction exposed on exterior or in occupied spaces, in manner that would, in Architect's opinion, reduce aesthetic qualities, or result in visual evidence of cutting and patching.
 - 2. Remove and replace Work that has been cut and patched in visually unsatisfactory manner.
 - 3. Engage recognized experienced and specialized fabricator to cut and patch following categories of exposed Work:
 - a. Processed concrete finishes.
 - b. Stucco and plaster.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Use materials that are identical to existing materials.
 - 1. Where identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to fullest extent possible with regard to visual effect.
 - 2. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.01 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed.
 - 1. Take corrective action before proceeding if unsafe or unsatisfactory conditions are encountered.

3.02 PREPARATION

- A. Temporary Support:
 - 1. Provide temporary support of Work to be cut.
 - 2. Review with Structural Engineer when necessary.
- B. Protection:
 - 1. Protect existing construction during cutting and patching to prevent damage.
 - 2. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take precautions necessary to avoid cutting existing pipe, conduit, or ductwork serving building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

- A. General:
 - 1. Employ skilled workmen to perform cutting and patching.
 - 2. Proceed with cutting and patching at earliest feasible time and complete without delay.
 - 3. Cut existing construction to provide for installation of other components or performance of other construction activities and subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting:
 - 1. Cut existing construction using methods least likely to damage elements to be retained or adjoining construction.
 - 2. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping.

3. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces.
 - a. Temporarily cover openings when not in use.
 4. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed surfaces.
 5. Cut through concrete and masonry using cutting machine such as carborundum saw or diamond core drill.
 6. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned.
 7. Cut-off pipe or conduit in walls or partitions to be removed.
 - a. Cap, valve or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching:
1. Patch with durable seams that are as invisible as possible.
 2. Comply with specified tolerances.
 - a. Where feasible, inspect and test patched areas to demonstrate integrity of installation.
 - b. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that will eliminate evidence of patching and refinishing.

3.04 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access.
1. Comply with requirements of Section 01 7423.

END OF SECTION 01 7329

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SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. References.
 - 2. System description for construction and demolition waste management.
 - 3. Submittals.
- B. Related Sections:
 - 1. Section 01 3300: Submittal Procedures.
 - 2. Section 01 4100: Regulatory Requirements.
 - 3. Section 01 5000: Temporary Facilities and Controls.
 - 4. Section 01 7423: Cleaning.
 - 5. Section 01 7700: Closeout Procedures.

1.02 REFERENCES

- A. California Integrated Waste Management Act of 1989 (AB 75).
- B. California Code of Regulations, Title 14 – Natural Resources
 - 1. Division 7 – Department of Resources Recycling and Recovery

1.03 SYSTEM DESCRIPTION

- A. Collection and separation of construction and demolition waste materials generated on-site as follows:
 - 1. Re-use or recycling on-site.
 - 2. Transportation to approved recyclers or re-use organizations.
 - 3. Transportation to legally designated landfills for purpose of recycling, salvaging, or reusing minimum of 50 percent of construction and demolition waste generated.

1.04 SUBMITTALS

- A. Construction and Demolition Waste Management Plan (Exhibit 1):
 - 1. Within 10 calendar days after Notice to Proceed and prior to waste removal, submit following to Owner for review and approval:
 - a. Materials to be recycled, re-used, or salvaged, either on-site or off-site.
 - b. Estimates of construction and demolition waste quantity (in tons) by type of material.
 - 1) When waste is measured by volume, give factors for conversion to weight in tons.
 - c. Procedures for recycling/re-use program.
 - d. Permit or license and location of Project waste disposal areas.
 - e. Site Plan for placement of waste containers.

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- B. Construction and Demolition Waste Management Monthly Progress Report (Exhibit 2):
 - 1. Submit Summary of waste generated by Project, monthly with Application for Payment. Include following:
 - a. Firms accepting recovered or waste materials.
 - b. Type and location of accepting facilities (landfill, recovery facility, or used materials yard).
 - 1) When materials are to be re-used or recycled on Project Site, location should be designated as "On-site Re-use/Recycling".
 - c. Type of materials and net weight (tons) of each.
 - d. Value of materials or disposal fee paid.
 - e. Attach weigh bills and other documentation confirming amount and disposal location of waste materials.
- C. Construction and Demolition Waste Management Final Compliance Report:
 - 1. Final update of Waste Management Plan to provide summary of total waste generated by Project.
- D. Waste management Report for Contractors (Exhibit 3):
 - 1. Complete attached form and submit to Owner.
- E. Solid Waste Management and Recycling Plan (Exhibit 4):
 - 1. Complete attached form and submit to Owner.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 IMPLEMENTATION

- A. Implement approved Waste Management Plan including collecting, segregating, storing, transporting and documenting each type of waste material generated, recycled or re-used, or disposed in landfills.
- B. Designate on-site person to be responsible for instruction workers and overseeing sorting and recording of waste/recyclable materials.
- C. Include waste management and recycling in worker orientation and as agenda item for regular project meetings.
- D. Limit recycle and waste bin areas to approved areas indicated on Waste Management Plan.
 - 1. Keep recycle and waste bins neat and clearly marked to avoid contamination of materials.

3.02 ATTACHMENTS

- A. Exhibit 1: Construction and Demolition Waste Management Plan.
- B. Exhibit 2: Construction and Demolition Waste Management Monthly Progress Report.
- C. Exhibit 3: Waste Management Report for Contractors.

D. Exhibit 4: Solid Waste Management and Recycling Plan.

END OF SECTION 01 7419

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EXHIBIT 1

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

CONSTRUCTION/MAINTENANCE/ALTERATION AND DEMOLITION PROJECTS

PROJECT NAME: _____

PROJECT NO: _____

NAME OF COMPANY:

CONTACT PERSON: _____

TELEPHONE: _____

PROJECT SITE LOCATION: _____

PROJECT TYPE:

___New Construction ___Demolition ___Maintenance/Alteration Projects

PROJECT SIZE (SQ.FT.): _____

DATE AND ESTIMATED PERIOD _____

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EXHIBIT 1 FORM

(1) Material Type	(2) Tons Estimated Recycle	(3) Tons Estimated Reuse	(4) Tons Estimated Salvage	(5) Tons Estimated Landfill	(6) Proposed Disposal or Recycling Facility
Total					
Diversion Rate: Columns[(2)+(3)+(4)] / [(2)+(3)+(4)+(5)]				=	
Signature		Title		Date	

Column 1: "Material Type" – Enter type of materials targeted for recycling, reuse, or requiring disposal.

Columns 2 through 4: "Estimated Generation" – Enter estimated quantities (tons) of recyclable, reusable, or salvageable waste materials anticipated to be generated and state number of salvageable items.

Column 5: "Estimated Landfill" – Enter quantities (tons) of materials to be disposed in landfill.

Column 6: "Disposal Location" – Enter end-destination of recycled, salvaged, and disposed materials.

General: (1) Attach proposed Recycling and Waste Bin Location Plan.
(2) Attach name and contact data for each recycling or disposal destination to be used.

EXHIBIT 2

**CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT MONTHLY PROGRESS
REPORT**

CONSTRUCTION/MAINTENANCE/ALTERATION AND DEMOLITION PROJECTS

PROJECT NAME: _____

PROJECT NO: _____

NAME OF COMPANY: _____

CONTACT PERSON: _____

TELEPHONE: _____

PROJECT SITE LOCATION: _____

PROJECT TYPE:

___ New Construction ___ Demolition ___ Maintenance/Alteration Projects

PROJECT SIZE (SQ.FT.): _____

DATE AND ESTIMATED PERIOD: _____

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EXHIBIT 2 FORM

(1) Material Type	(2) Tons Actual Recycle	(3) Tons Actual Reuse	(4) Tons Actual Salvage	(5) Tons Actual Landfill Name	(6) Disposal or Recycling Facility (e.g. Onsite, of Facility)
Total					
Diversion Rate: Columns[(2)+(3)+(4)] / [(2)+(3)+(4)+(5)]				=	
Signature		Title		Date	

Column 1: "Material Type" – Enter type of materials targeted for recycling, reuse, or requiring disposal.

Columns 2 through 4: "Estimated Generation" – Enter estimated quantities (tons) of recyclable, reusable, or salvageable waste materials anticipated to be generated and state number of salvageable items.

Column 5: "Estimated Landfill" – Enter quantities (tons) of materials to be disposed in landfill.

Column 6: "Disposal Location" – Enter end-destination of recycled, salvaged, and disposed materials.

General: (1) Attach proposed Recycling and Waste Bin Location Plan.
(2) Attach name and contact data for each recycling or disposal destination to be used.

EXHIBIT 3

WASTE MANAGEMENT REPORT FOR CONTRACTORS

Complete this form each time materials are removed from

Project Site or reused onsite.
Submit to Owner's Project Manager.

PROJECT SITE LOCATION: _____ DATE: _____

COMPANY: _____

—

MATERIAL: _____

WAS THE MATERIAL RECYCLED: YES _____ NO _____

VOLUME/WEIGHT: _____

RECYCLING COMPANY OR DISPOSAL
SITE: _____

SUBMITTED

BY: _____

PHONE NUMBER: _____

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EXHIBIT 4

SOLID WASTE MANAGEMENT AND RECYCLING PLAN

Prepare Waste Management and Recycling Plan by completing the following form for Construction and Demolition materials produced because of Work performed at Citrus Community College District. Owner requires that Contractors recycle materials when there is viable recycling company available.

Owner's Environmental Health and Safety Supervisor will assist applicants in developing and implementing Waste Management and Recycling Plan.

COMPANY NAME: _____ CONTACT: _____

ADDRESS: _____ PHONE: _____

PROJECT SITE: _____

Please fill out following form for submittal.

Form will help to identify types of materials, estimated quantities of materials, and how material will be transported and recycled or disposed.

Should you have questions regarding this form or recycling and disposal, please contact Oscar Saghie, Campus Project Manager, OSaghieh@fullcoll.edu, or Megan Moscal, Assistant Project Manager, MMoscol@fullcoll.edu

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EXHIBIT 4 FORM

Circle the material that will be generated at the construction site, estimate the quantity, list how the materials will be transported, and write in where the materials will be taken.

MATERIALS	ESTIMATED QUANTITY (in yards and tons)	HAULER (List hauler's name if not self-haul)	RECYCLING COMPANY OR DISPOSAL SITE
Salvage and used building			
Wood			
Plant Debris			
Wallboard			
Glass			
Soil			
Corrugated cardboard			
Metals			
Masonry/Tile			
Concrete/Asphalt			
Toilets (porcelain)			
Carpet Padding (foam)			
Other			
Mixed Loads (i.e. trash)			

FOR DISTRICT USE ONLY:

Approval Status:

_____ Approved

_____ Further explanation needed, see attached

_____ Denied

Reviewed by: _____ Date: _____

SECTION 01 7423

CLEANING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Performance of cleaning, during progress of Work, and at completion of Work, as required by General Conditions.
- B. Related Sections:
 - 1. Section 01 5000: Temporary Facilities and Controls; additional requirements for dust and debris control.
 - 2. Section 01 7419: Construction Waste Management and Disposal.
- C. Related Requirements:
 - 1. Refer to District's Division 00 Documents, including General Conditions, for additional requirements.
 - 2. Cleaning for specific products of Work:
 - a. Specification Section for that Work.

1.02 QUALITY ASSURANCE

- A. Verify that requirements of cleanliness are being met.

1.03 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations in compliance with applicable codes, ordinances, regulations, and anti-pollution laws.
 - 1. Comply with requirements of Section 01 7419.
- B. In addition to specified requirements, comply with applicable requirements of fire and governing authorities having jurisdiction.

1.04 PAYMENT WITHHELD

- A. Architect reserves right to withhold certification of payment requests for failure on part of Contractor to regularly clean Project in conformance with requirements of this Section.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.

- C. Use cleaning materials only on surfaces recommended by cleaning products manufacturer.

PART 3 EXECUTION

3.01 PROGRESS CLEANING DURING CONSTRUCTION

- A. Execute periodic cleaning to keep Work, Project Site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.
 - 1. Maintain stored items in orderly arrangement allowing maximum access and providing required protection of materials.
 - a. Provide on-site containers for collection of waste materials, debris and rubbish.
 - 2. Provide adequate storage for waste materials awaiting removal from Project Site, observing requirements for fire protection and protection of environment.
 - 3. Handle hazardous, dangerous or unsanitary waste materials separately from other waste material by placing it in proper containers.
 - 4. Burying or burning of waste materials is not permitted.
 - 5. Remove waste materials, debris and rubbish from Project Site periodically and dispose of at legal disposal areas away from Project Site.
- B. Project Site:
 - 1. Inspect Project Site daily and pick up scrap, debris, and waste material.
 - a. Place waste material in designated containers.
 - 2. Keep flammable waste in sealed metal containers until removed from Project Site.
 - 3. Maintain Project Site clear of debris so as not to impede construction and fire department access
- C. Structures:
 - 1. Weekly, and more often if necessary, inspect structures and pick up scrap, debris, and waste material.
 - a. Remove items and place in designated container.
 - 2. Weekly, sweep interior spaces clean.
 - a. Keep space free from dust and other material capable of being removed by handheld broom, (i.e.: "broom clean").
 - 3. Preparatory to installation of succeeding material, clean structures or pertinent portions as required to degree of cleanliness recommended by manufacturer of succeeding material.
 - 4. Following installation of finish floor materials, clean finish floor daily, and more often if necessary.
 - a. Provide adequate protection of finish where Work is being performed in space in which finish materials have been installed.
 - b. For purpose of this subparagraph, term "Clean", is to be interpreted as meaning free from foreign materials that, in opinion of Architect, may be injurious to finish floor material, (i.e.: "vacuum clean").

3.02 DUST CONTROL

- A. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

- B. Prior to completion of Work, remove from Project Site, tools, surplus materials, equipment, scrap, debris, and waste.
- C. Employ experienced workers for final cleaning.
- D. Complete following cleaning operations before requesting inspection for Certification of Substantial Completion:
 - 1. Site:
 - a. Clean Site, including landscape development areas, of rubbish, litter and other foreign substances.
 - b. Sweep paved areas broom clean, including public paved areas directly adjacent to Project Site.
 - 1) Remove stains, spills and other foreign deposits.
 - c. Rake grounds that are neither paved nor planted, to smooth even-textured surface and remove resultant debris.
 - 2. Exterior and Interior:
 - a. Clean exposed exterior and interior hard-surfaced finishes to dust-free condition
 - b. Remove traces of soils, waste material, smudges and other foreign matter.
 - c. Remove traces of splashed material from adjacent surfaces.
 - d. Remove materials using equipment as instructed by manufacturer of surface materials to be cleaned.
 - e. Leave concrete floors broom clean.
 - 3. Carpeted Surfaces:
 - a. Use only dry-chemical method of cleaning.
 - b. Do not use steam cleaning or water based cleaning on carpet.
 - c. Use materials and methods fully approved by carpet manufacturer, as instructed in manufacturer's published literature.
 - d. Vacuum carpet.
 - 4. Labels:
 - a. Remove labels that are not permanent labels.
 - 5. Transparent Materials:
 - a. Clean transparent material, including mirrors and glass in doors and windows.
 - b. Remove glazing compound and other substances that are noticeable vision obscuring materials.
 - c. Replace chipped or broken glass and other damaged transparent materials.
 - d. Restore reflective surfaces to their original reflective condition.
 - e. Clean glass inside and outside.
 - f. Polished Surfaces:
 - 1) Apply polish recommended by manufacturer of material being polished to surfaces requiring routine application of buffed polish.
- E. Ventilating Systems:
 - 1. Clean permanent filters and replace disposable filters when units were operated during construction.
 - 2. Clean ducts, blowers and coils when units were operated without filters during construction.

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- F. Wipe surfaces of electrical equipment.
 - 1. Remove excess lubrication and other substances.
 - 2. Clean plumbing fixtures to sanitary condition.
 - 3. Clean light fixtures and lamps.
- G. Comply with regulations of authorities having jurisdiction and safety standards for cleaning.
 - 1. Do not burn waste materials.
 - 2. Do not bury debris or excess materials on Owner's property.
 - 3. Do not discharge volatile, harmful or dangerous materials into drainage systems.
 - 4. Remove waste materials from Project Site and dispose of in lawful manner.
 - 5. Where extra materials of value remaining after completion of associated Work have become Owner's property, arrange for disposition of these materials as directed.
- H. Prior to final completion, or Owner occupancy, conduct inspection of sight-exposed exterior surfaces, and Work areas, to verify that entire Work is clean.

3.04 CLEANING DURING OWNER'S OCCUPANCY

- A. Should Owner occupy portion of Project prior to its final completion by Contractor, comply with acceptance of partial occupancy by Owner/Architect in accordance with General Conditions of the Contract.

END OF SECTION 01 7423

SECTION 01 7700
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements for Project Closeout, including but not necessarily limited to:
 - a. Inspection procedures.
 - b. Substantial Completion
 - c. Final Acceptance
- B. Related Sections:
 - 1. Section 01 7423: Cleaning
 - 2. Section 01 7839: Project Record Documents
- C. Related Requirements:
 - 1. Closeout requirements for specific construction activities are included in appropriate Sections in Divisions 02 through 33.

1.02 BENEFICIAL OCCUPANCY AND ACCEPTANCE OF SUBSTANTIAL COMPLETION

- A. Comply with CCR, Title 24, Part 1 – Administrative Code, Section 4-336 CCR (Schools) Requirements for Closeout Procedures.
 - 1. Comply with additional requirements in District's Division 00 Sections and General Conditions of the Contract.
- B. Preliminary Procedures:
 - 1. Before requesting inspection for certification of Substantial Completion, complete following.
 - a. List exceptions in request.
 - 2. In application for payment that coincides with, or first follows, date Substantial Completion is claimed, show one hundred percent completion for portion of Work claimed as substantially complete.
 - a. Include supporting documents for completion as indicated in Contract documents and statement showing accounting of changes to Contract Sum.
 - b. When one hundred percent completion cannot be shown, include list of incomplete items, value of incomplete construction, and reasons Work is not complete.
 - 3. Make required submittals of specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents, along with record drawings and similar final record information in accordance with requirements in Section 01 7839.
 - 4. Complete final clean up requirements in accordance with Section 01 7423, including touch-up painting.
 - a. Touch-up and otherwise repair and restore marred exposed finishes.

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C. Inspection Procedures:

1. Upon receipt of request for inspection, Architect will either proceed with inspection or advise Contractor of unfilled requirements.
2. Should Architect and Owner determine that Work is not substantially complete:
 - a. Architect will promptly notify Contractor in writing, giving reason(s) for his determination.
 - b. In conjunction with Inspector of Record and Construction Manager, Architect will prepare list of items (Punch List) to be completed or corrected.
 - 1) Punch List may be developed for less than entire project, when approved by Architect and Owner.
 - c. Remedy deficiencies and notify Architect when Work is ready for reinspection.
 - d. Architect will prepare Certificate of Substantial Completion, accompanied by Punch List, following inspection, or advise Contractor of construction that must be completed or corrected before certificate will be issued
3. Architect will repeat inspection when requested and if assured that Work has been substantially completed in each phase, will submit Certificate of Substantial Completion to Contractor and Owner for their written acceptance of responsibilities assigned them in Certificate.
 - a. Owner reserves right to occupy each completed phase upon issuance of Certificate of Substantial Completion.
4. Results of completed inspection will form basis of requirements for final acceptance.

D. Mandatory Substantial Completion Submittals:

1. To include, but are not necessarily limited to:
 - a. Redlined' As-Built Set (marked up drawings).
 - b. On As-Built Set and Specifications manual record revisions to original contract document with contrasting color.
 - c. Operation and Maintenance Manuals for items specified in pertinent Sections and for other items approved by Architect.
 - d. Warranties and Guarantees.
 - e. Training.
 - f. Spare parts, materials, and extra stock.
 - g. Evidence of payment and release of liens, when requested by Owner.
 - h. List of Subcontractors, service organizations and principal vendors, including current names, addresses and telephone numbers, where they may be contacted for emergency service, including nights, weekends, and holidays.

1.03 FINAL ACCEPTANCE

A. Preliminary Procedures:

1. Before requesting final inspection for certification of final acceptance and final payment, complete following.
 - a. List exceptions in request.
2. Prepare and submit Project Closeout Request notice that Work is ready for final inspection and acceptance.
3. Architect, and Owner's Project Inspector will verify that Punch List items are complete.
4. Should Architect or Owner's Project Inspector determine Work is incomplete or defective:

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- a. Architect or Owner's Project Inspector will promptly notify Contractor in writing, listing incomplete or defective work.
 - b. Remedy deficiencies promptly and notify Owner's Project Inspector when ready for re-inspection.
- B. Reinspection Procedure:
1. Architect will reinspect Work upon receipt of notice that Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to Architect.
 2. Upon completion of reinspection, Architect will prepare certificate of final acceptance, or advise Contractor of Work that is incomplete, or of obligations that have not been fulfilled but are required for final acceptance.
 3. When necessary, reinspection will be repeated.
 4. When Architect determines Work is acceptable under Contract Documents, he will notify Owner's Project Inspector that Project is complete per Contract Drawings and Specifications.
 5. Upon acceptance, Contractor must certify that Project has been completed in compliance with Contract Documents.
 - a. Submit copies of this report to following:
 - 1) Architect.
 - 2) Owner's Project Inspector.
- C. Final Payment Procedure.
1. Submit following in accordance with requirements of Section 01 7839:
 - a. Final payment request with releases and supporting documentation not previously submitted and accepted.
 - b. Include certificates of insurance for products and completed operations where required.
 2. Updated final statement, accounting for final additional changes to Contract Sum.
 3. Certified copy of Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and list has been endorsed and dated by Architect.
 4. Consent of surety to final payment.
 5. Comply with additional requirements in District's Division 00 Sections and General Conditions of the Contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 7700

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SECTION 01 7839

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements for preparing, maintaining, and submitting following:
 - a. Project Record Documents.
 - b. Operating and Maintenance Data and Manuals.
 - c. Warranties, Guarantees, and Bonds.
 - d. Spare parts and Maintenance Materials.
 - e. Instructions to Owner's Personnel.
- B. Related Sections:
 - 1. Section 01 7700: Closeout Procedures
- C. Related Requirements:
 - 1. Refer to District's Division 00 Documents, including General Conditions, for additional requirements.
 - 2. Separate Specification Sections requiring Record Documents.

1.02 PROJECT RECORD DOCUMENTS

- A. Dedicated Record Set:
 - 1. Maintain one set of Contract Drawings and one copy of Project Specifications for use during construction to record changes made during construction..
 - a. Record revisions with contrasting color.
 - b. Do not use record documents for construction purposes.
- B. Record Documents and Shop Drawings:
 - 1. Record in concise and neat manner and on continual basis actual revisions to Work.
 - 2. Include reference to appropriate document with date revision/change was approved or directed.
 - 3. Changes/Revisions to Drawings and Specifications include, but are not necessarily limited to:
 - a. Changes made by RFI, CCD, and CO.
 - b. Changes made to shop drawings.
 - 4. Mark set to show actual installation where installation varies substantially from Work as originally shown.
 - a. Mark whichever drawing is most capable of showing conditions fully and accurately.
 - b. Where shop drawings are used, record cross-reference at corresponding location on Contract drawings.
 - c. Give particular attention to concealed elements that would be difficult to measure and record at later date.
 - 5. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of Work.

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6. Mark new information that is important to Owner, but was not shown on Contract Drawings or shop drawings.
 7. Note related Change Order numbers where applicable.
 8. Label each document "**PROJECT RECORD**" in neat large printed letters.
 9. Record information concurrently with construction progress.
 - a. Do not conceal Work until required information is recorded.
 10. Legibly mark each item to record actual construction including:
 - a. Measured depths of foundations in relation to finish first floor datum.
 - b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 1) Identify drains and sewers by invert elevation.
 - c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of Work.
 - d. Identify ducts, dampers, valves, access doors and control equipment wiring.
 - e. Field changes of dimension and detail.
 - f. Details not on original Drawings.
- C. Store Record Documents and Samples in Contractor's Field Office, separate from documents used for construction.
1. Protect record documents from deterioration and loss in secure, fire-resistive location.
 2. Provide access to record documents for Architect's reference during normal working hours.
 3. Provide files and racks for storage of Documents
 4. Provide secure storage space for storage of samples.
 5. Maintain documents in clean, dry, legible condition and in good order.
 - a. Replace soiled or illegible documents.
- D. Record Specifications:
1. Maintain one complete copy of Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction.
 2. Legibly mark these documents and record at each product section description of actual products installed to show substantial variations in actual Work performed in comparison with text of specifications and modifications including following:
 - a. Manufacturer's name, trade name, product model and number and supplier.
 - b. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation, including following:
 - 1) Authorized product substitutions or alternates utilized.
 - 2) Changes made by Addenda and Modifications.
 3. Note related record drawing information and product data.
 4. Upon completion of Work, submit record specifications to Architect for Owner's records.
- E. Owner's Project Inspector will verify that Project Record Documents are fully updated prior to approving Payment Applications.
1. Obtain Owner's Inspector's signature on record set verifying information.
- F. Record drawings will be reviewed by Architect for completeness and acceptance.

- G. As-Built Drawings:
1. Turn over to Owner in following manner:
 - a. Separate each discipline (i.e. Civil, Architectural, Mechanical, Electrical, Plumbing, and so on)
 - b. Identify disciplines of Drawings by adding white tag.
 - c. Tag each discipline.
 - d. Tag Size: No. 8, 8-11/16 by 2-3/4 inches.
 - e. Legibly write on tag name of Project, and discipline inside tube.
 - f. Separately tube each discipline by using U-Line tube or equal.
 - g. Size of Tube: 4 inches minimum and 6 inches maximum.
- H. Record of Electronic (Digital) Files:
1. Immediately before inspection of Substantial Completion, review marked-up Record Set with Architect and Owner's Inspector.
 2. When authorized, prepare full set of corrected digital files of Record Documents.
 3. Submit following documents:
 - a. Scan sheets in As-Built Set, furnish annotated PDF electronic files.
 - b. CD or CD's of PDF files and file labeling is to include following information:
 - 1) Project name.
 - 2) Date.
 - 3) Name of Architect.
 - 4) Name of Contractor
 - 5) Disciplines included in CD (i.e. Title sheet, Civil, Architectural, Structural, Mechanical, and so on)
 - 6) Label and index files contained in CD in sequential order to match Title Sheet of Contract Documents.
- I. RFI's:
1. Furnish one copy of RFI's questions and answers submitted on Project.
 2. Submit RFI binder in following manner:
 - a. Provide binders as specified in "Record Document Storage" Article.
 - b. Label binder on cover and spine: RFI's.
 - 1) Identify Project Name/Building Name, and Project Number on cover.
 - c. Furnish tab for each individual RFI.
 - d. Submit RFI Binders inside storage boxes as specified in "Record Document Storage" Article.
 - 1) Include two labels on face and side of box or boxes.

1.03 MAINTENANCE AND OPERATING (M&O) DATA AND MANUALS

- A. Submit two sets prior to Substantial Completion inspection for Architect's review and approval.
- B. Manual Format:
1. Prepare data in form of instructional manual for use by Owner's personnel.
 - a. Provide binders as specified in "Record Document Storage" Article.
 - b. Identify Project Name/Building Name and Project Number on cover of manual.
 2. Table of Contents: Include in each volume, neatly typewritten.
 - a. Identify Contractor, name of responsible principal, address, and phone number.

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- b. List each product included, indexed to content of volume.
 - c. List, with each product, name, address, and telephone number of subcontractor or installer and maintenance contractor, as appropriate and nearest source of supply for parts and replacement.
 - d. Identify location of installed equipment.
 - e. Submit M&O Manuals inside storage boxes as specified in "Record Document Storage" Article.
- 3. Product Data:
 - a. Include only those sheets which are pertinent to specific product.
 - b. Annotate each sheet to clearly identify specific product or part installed.
 - c. Include CD with Product Data information.
 - 1) Maintenance schedules and equipment list must be in editable Word or Excel spreadsheet format.
- 4. Drawings:
 - a. Supplement product data with Drawings as necessary to clearly illustrate relations of component parts of equipment and systems.
 - b. Coordinate Drawings with information in Project Record Documents to ensure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 - d. Full size and half size hard copies of Drawings are required.
- 5. Copy of each warranty and service contract as specified.

1.04 RECORD DOCUMENT STORAGE

- A. Binders:
 - 1. Commercial quality, heavy-duty, three-ring D binders with durable and cleanable vinyl-covers at front and spine, with internal pockets to hold CD.
 - 2. Size: 8-1/2 by 11 inches with ring size as required.
 - 3. Provide new white binders.
- B. Storage Boxes:
 - 1. "Bankers Box" or equal quality.
 - a. Size: 11 by 15 inches or equal size.
 - 2. Include two labels on face and side of box.
 - 3. Label boxes as follows:
 - a. Use Avery Label 6573 or equal size.
 - b. Type information on label, including Bid No., Project Name, and Number of boxes (i.e. Box 1 of 5).
 - 1) Refer to attached sample label at end of this Section.
 - 2) Font for Labels:
 - a) Vernada, 48 point for Bid No.
 - b) Vernada, 16 point for remainder of content on label.

1.05 WARRANTIES, GUARANTEES, AND BONDS

- A. Disclaimers and Limitations:
 - 1. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of warranty on Work that incorporates products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with Contractor.

- B. Manufacturer's warranties and guarantees notwithstanding, warrant entire Work against defects in materials and workmanship for twelve months from Date of Acceptance of Substantial Completion.
 - 1. Warranties and guarantees between Contractor and Owner are not affected by warranties and guarantees between Contractor and manufacturers and Contractor and suppliers.

1.06 WARRANTY REQUIREMENTS

- A. Related Damages and Losses:
 - 1. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty:
 - 1. When Work covered by warranty has failed and been corrected by replacement or rebuilding, reinstate warranty by written endorsement.
 - 2. Provide Reinstated Warranty equal to original warranty with equitable adjustment for depreciation.
- C. Replacement Cost:
 - 1. Upon determination that Work covered by warranty has failed, replace or rebuild Work to acceptable condition complying with requirements of Contract Documents.
 - 2. Contractor is responsible for cost of replacing or rebuilding defective Work regardless of whether Owner has benefited from use of Work through portion of its anticipated useful service life.
- D. Owner's Recourse:
 - 1. Written warranties made to Owner are in addition to implied warranties, and do not limit duties, obligations, right and remedies otherwise available under law, nor are warranty periods be interpreted as limitations on time in which Owner can enforce such other duties, obligations, rights, or remedies.
 - 2. Rejection of Warranties:
 - a. Owner reserves right to reject warranties and to limit selections to products with warranties not in conflict with requirements of Contract Documents.
- E. Owner reserves right to refuse to accept Work for Project where special warranty, certification, or similar commitment is required on such Work or part of Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- F. Submit warranties and guarantees to Contractor for Architect's review and approval prior to final payment.
- G. Do not start warranty period for delayed warranty items, until items have been completed.
- H. Furnish two original copies with wet signatures of warranties and guarantees on Project.

- I. Organize warranties/guarantees into orderly sequence based on Table of Contents in Project Specifications:
 1. Bind warranties/guarantees in 8-1/2 by 11 inch heavy-duty, three ring binders, same as specified in "Maintenance And Operating (M&O) Data and Manuals" Article.
 2. Identify each binder on front and spine with printed sheet "**WARRANTIES**", project name and name of contractor.
 3. Contractor to issue Contractor's and Subcontractor's Warranties/Guarantees using attached Warranties/Guarantees form found at end of this Section.

1.07 SUBMITTALS

- A. Submit written warranties to Architect prior to date certified for Substantial Completion.
 1. When Architect's Certificate of Substantial Completion designates commencement date for warranties other than date of Substantial Completion for Work, or designated portion of Work, submit written warranties upon request of Architect.

1.08 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit (2) copies of final approved manual to Owner's Project Inspector prior to final payment.
- B. Content for each unit of mechanical equipment and each mechanical system, as applicable and appropriate, including but not limited to following:
 1. Description of units, or system and component parts.
 2. Operating procedures.
 3. Maintenance procedures.
 4. Servicing and lubrication schedule, with list of lubricants required.
 5. As-installed control diagrams by controls manufacturer.
 6. Other data as required in various specification sections.
- C. Content, for each electrical and electronic system, as applicable and appropriate, including but not limited to following:
 1. Description of system and component parts.
 2. Circuit directories of panel boards.
 3. As-installed color-coded wiring diagrams.
 4. Operating procedures.
 5. Maintenance procedures.
 6. Other data as required in individual sections.
- D. Prepare and include additional data as may be required for instruction of Owner's personnel.
- E. Additional requirements for operating and maintenance data: As may be specified in individual Sections.
- F. Provide complete information for products specified in individual Sections.

1.09 INSTRUCTION OF OWNER'S PERSONNEL

- A. Provide instruction/training to Owner personnel as indicated in individual specification sections and as required.
- B. Provide to Owner, date and list, including signatures, of Owner personnel who attended training.
 - 1. Schedule instructional meeting or meetings after instructional manuals have been submitted, reviewed, and approved by Architect.
 - 2. Coordinate meetings to include tier subcontractors.
- C. Instruction sessions will be held in Owner designated area on Project Site and at Owner's convenience.
 - 1. Schedule amount of time required for each session as specified in individual sections.
- D. Review contents of Manuals with Owner's personnel in full detail to explain every aspect of operation and maintenance.

1.10 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual Sections.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 7839

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WARRANTY/GUARANTEE FORM

FOR _____ WORK

We, the undersigned, do hereby warranty and guaranty that the parts of the Work described above which we have furnished or installed for:

Project Name: (Insert Project Name)

Owner: (Insert Owner's Name)

Location: (Insert Project Location)

Are in accordance with the Contract Documents and that all said work as installed with fulfill or exceed all the Warranty and Guaranty requirements. We agree to repair or replace work installed by us, together with any other work which is displaced or damaged by so doing, that proves to be defective in workmanship, material, or operation within a period of:

(Insert written years) year(s)

from the date of filing of the Notice of Completion, ordinary wear and tear and unusual neglect or abuse excepted.

In the event of our failure to comply with the above-mentioned conditions within a reasonable time period determined by the Owner, after notification in writing, we, the undersigned, all collectively and separately, hereby authorize the Owner to have said defective work repaired and/or replaced and made good, and agree to pay to the Owner upon demand all monies that the Owner may expend in making good said defective work, including all collection costs and reasonable attorney fees.

Date:

(Insert Name of Contractor)

(Insert Name of Subcontractor, Manufacturer or Supplier)

Signature:

Signature:

Name: Name:

Title: Title:

State License No.

State License No.:

Local Representative: For maintenance, repair, or replacement service, contact:

Name:

Address:

Phone:

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Bid No. XXXX

[Project Name]

DSA No. N/A

RFI BINDERS 01 OF 04

BINDERS 01 OF 04: RFI'S 001 THRU 050

BINDERS 02 OF 04: RFI'S 051 THRU 100

BINDERS 03 OF 04: RFI'S 101 THRU 150

BINDERS 04 OF 04: RFI'S 151 THRU 200

Box 1 of 5

SAMPLE

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SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Formwork for cast-in-place concrete and installation of embedded items.
 - 2. Reinforcing steel for concrete.
 - 3. Reinforced concrete with compressive strengths as indicated on Structural Drawings.
 - 4. Work includes but is not necessarily limited to:
 - a. Under-slab moisture vapor barrier/retarder
 - b. Footings for:
 - 1) Concrete masonry walls at storage building.
 - 2) Concrete retaining walls.
 - 3) Chain link fence and gates.
 - 4) Decorative metal fences and gates in Alternate
 - b. Concrete slab for storage building
 - 5. Concrete Finishing:
 - a. Broom finish on interior slab.
 - b. Concrete sealer.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 01 4500: Quality Control
 - 3. Section 01 4525: Concrete Moisture Testing
 - 4. Section 05 5000: Metal Fabrications
 - 5. Section 07 9200: Joint Sealants
 - 6. Section 09 0562: Moisture Vapor Emission Control System; emissions control for floor coatings.
 - 7. Section 32 0523: Concrete for Exterior Improvements; miscellaneous site concrete not specified elsewhere.
 - 8. Section 32 1313: Concrete Paving; walks and curbs.
- C. Products Furnished But Not Installed Under This Section:
 - 1. Reinforcing steel for masonry work.
- D. Products Installed But Not Furnished Under This Section:
 - 1. Built-in anchors, inserts, bolts and other embedded items for connection of other Work.
 - 2. Built-in sleeves, thimbles.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
 - 1. Chapter 19A – Concrete

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B. ASTM International (ASTM):

1. ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
2. ASTM A 706 – Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
3. ASTM A 1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
4. ASTM C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
5. ASTM C 33 - Standard Specification for Concrete Aggregates
6. ASTM C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
7. ASTM C 42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams
8. ASTM C 88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
9. ASTM C 94 – Standard Specification for Ready-Mixed Concrete
10. ASTM C 143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
11. ASTM C150 – Standard Specification for Portland Cement
12. ASTM C 171 – Standard Specification for Sheet Materials for Curing Concrete
13. ASTM C 595 – Standard Specification for Blended Hydraulic Cements
14. ASTM C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
15. ASTM C 685 – Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing
16. ASTM D 882 – Test Method for Tensile Properties of Thin Plastic Sheet
17. ASTM D 1434 – Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheet
18. ASTM D 1709 – Test Methods for Impact Resistance of Plastic Film by Free-Falling Dart Method
19. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
20. ASTM D 1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
21. ASTM D 2419 – Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
22. ASTM E 329 – Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
23. ASTM E 1745 – Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
24. ASTM F 1249 – Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheet Using a Modulated Infrared Sensor

C. American Concrete Institute (ACI):

1. ACI 117 – Specification for Tolerances for Concrete Construction and Materials (ACI 117-10) and Commentary-Reapproved 2015
2. ACI 301 – Specification for Structural Concrete for Buildings.
3. ACI 302.1R – Guide to Concrete Floor and Slab Construction
4. ACI 302.2R – Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

5. ACI 304 – Recommended Practice for Measuring, Mixing and Placing Concrete.
 6. ACI 305 – Recommended Practice for Hot Weather Concreting.
 7. ACI 306 – Recommended Practice for Cold Weather Concreting.
 8. ACI 318 – Building Code Requirements for Reinforced Concrete.
 9. ACI 347 – Recommended Practice for Concrete Formwork
- D. California Department of Transportation (Caltrans):
1. Office of Materials Engineering and Testing Services:
 - a. California Test Methods (CTM):
 - 1) CTM 217 – Method of Test for Sand Equivalent.
 - 2) CTM 227 – Method of Test for Evaluating Cleanness of Coarse Aggregate
- E. The Engineered Wood Association (APA):
1. Voluntary Product Standard Structural Plywood (PS 1-09)
 2. Guide to Plywood Grades
- F. West Coast Lumber Inspection Bureau (WCLIB):
1. Standard Grading Rules No. 17, current edition.
- G. American Welding Society (AWS):
1. AWS D1.4 – Structural Welding Code – Reinforcing Steel.
 2. AWS D1.8 – Seismic Welding Supplement.
- G. South Coast Air Quality Management District (SCAQMD):
1. Rule 1113 – Architectural Coatings

1.03 SUBMITTALS

- A. Product Data:
1. Manufacturer's product data with installation instructions for proprietary materials including reinforcement and forming accessories, form coatings, admixtures, joint materials, sealers/hardeners, curing materials (when permitted), and others as requested by Architect.
- B. Mix Designs:
1. Prepare mix designs for Architect's review and include following information in mix design data:
 - a. Design:
 - 1) Project name, address, Site location, and location of design usage.
 - 2) Contractor, Sub-Contractor, Supplier and Plant Location.
 - 3) Mix Number.
 - 4) Specified compressive strength, maximum aggregate size, slump, and placement method.
 - 5) Application and location in structure.
 - 6) Signature and stamp of licensed civil engineer responsible for mix design.
 2. Materials:
 - a. Design Method.
 - b. Water-Cement Ratio.
 - c. Cement:
 - 1) Type, amount, and compliance with specified criteria statement.

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- d. Aggregates:
 - 1) Source(s), gradations (Individual and combined).
- e. Admixtures:
 - 1) Brand, classification, dosage, addition method.
 - 2) Obtain specified approvals for admixtures prior to including in mix designs.
- f. Water source.
- g. Test Results, Batch Quantities, Yield (calculations).
- 3. Special Considerations:
 - a. Unit Weight.
 - b. Other considerations relative to placement, curing, finish, and testing.
- C. Shop Drawings:
 - 1. Cast-in-place Concrete:
 - a. Show construction joint locations and details.
 - 2. Reinforcing Steel:
 - a. No submittals are required.
 - b. Providing steel reinforcing as indicated on Drawings and as specified herein is responsibility of Contractor.
 - c. Prepared Shop Drawings are solely for use by Contractor and will not be reviewed or approved by Architect or Structural Engineer.
- D. Batch Plant Certificates:
 - 1. Accompany each load of materials or concrete with signed copy of batch plant certificate stating quantity of each material, amount of water, admixtures, departure time and date.
 - 2. When continuous batch plant inspection is waived, provide affidavit in accordance with Title 24, CBC, Part 2, Section 1704A.3.3 to Owner's Testing Laboratory.
- E. Testing and Inspection Reports:
 - 1. Owner's Testing Agency:
 - a. Laboratory Reports:
 - 1) Laboratory test or evaluation reports for concrete materials and mix designs, performed in accordance with Section 01 4500, to Owner, Architect, Contractor, and Division of the State Architect.
 - 2) Do not begin concrete production until mix designs have been reviewed and accepted by Architect.
 - 2. Reinforcing Steel Reports:
 - a. Certified mill test reports (tensile and bending) for each heat or melt of steel prior to delivery of material to Project Site.
 - b. Where reinforcing is to be welded, furnish mill test reports verifying weldability of steel.
- F. Contractor's Certifications:
 - 1. Testing Laboratory's Certificate of Compliance.
 - 2. Certified copies of mix designs for each concrete class specified including compressive strength test reports.
 - 3. Certification that materials meet requirements specified.
 - 4. Certification from vendor that samples originate from and are representative of each lot proposed for use.
- G. Schedule of placing for Architect's review before starting Work.

- H. Samples:
1. Upon request of Architect
 - a. Furnish formwork and accessories, including expansion joint fillers.
 - b. Concrete sealer/harder products as required for application to mock-up slab panels.

1.04 QUALITY ASSURANCE

- A. Formwork and Accessories:
1. Design Criteria: Formwork conforming to ACI 347.
 - a. Design Formwork to:
 - 1) Prevent leakage or washing out of cement mortar.
 - 2) Resist spread, shifting, and settling.
 - 3) Reproduce accurately required lines, grades, and surfaces within tolerances specified.
 - b. Safety:
 - 1) Responsibility for adequate strength and safety of formwork including falsework, and shoring rests with Contractor.
 2. Allowable Tolerances:
 - a. Construct Formwork to produce concrete within tolerance limits recommended in ACI 347, unless otherwise noted.
- B. Reinforcing:
1. Welders' Qualifications:
 - a. Qualify welders in accordance with AWS D1.4 and AWS D1.
 2. Do not permit reinforcing steel to rust where there is danger of staining exposed surfaces of adjacent concrete.
 - a. Replace rust-stained concrete at Contractor's expense.
 3. Allowable Tolerances:
 - a. Place reinforcing steel within tolerances permitted by ACI 318, Section 26.6.2, unless otherwise approved by Architect.
 4. Owner's Testing Agency will provide tests in accordance with CBC Chapter 17A.
 - a. Collect mill test reports for reinforcement.
 - b. Take samples from bundles at fabricators.
 - 1) When bundles are identified by heat number and accompanied by mill analysis, take two specimens from each ten tons, or fraction thereof, of each size and grade.
 - 2) When reinforcement is not positively identified by heat numbers or when random sampling is intended, take two specimens from each 2 tons, or fraction thereof, of each size and grade.
 5. Test for Tensile and Bending Strengths:
 - a. Provide inspection of welding, including prior fit-up, welding equipment, weld quality and welder certification in accordance with AWS D1.4 and AWS D1.8
 - b. Perform chemical analysis sufficient to determine carbon equivalent and minimum preheat temperature when reinforcement does not conform to low-alloy steel requirements of CBC Section 1903A.8.

- C. Concrete:
 - 1. Testing Laboratory Qualifications:
 - a. Testing Laboratory under direction of registered Civil Engineer licensed in State of California, having operated successfully for four years prior to this Work, conforming to requirements of ASTM E 329.
 - 2. Requirements of ACI 301 govern Work, materials, and equipment related to this Section.
 - a. Specifications set minimum results required, and references to procedures are intended to establish minimal guides.
 - 3. Responsibility for quality of concrete in place rests with Contractor who also bears burden of proof that concrete meets minimum requirements.
 - 4. Placing of concrete by means of pumping will be acceptable method of placement providing that Contractor can demonstrate that:
 - a. Specified concrete strengths will be met.
 - b. Equipment has record of satisfactory performance under similar conditions and using similar mix.
 - c. Trial batches have been made.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General:
 - 1. Ensure storage facilities are weather tight and dry.
 - 2. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.
- B. Reinforcing:
 - 1. Deliver reinforcement and accessories to Project Site not more than 48 hours before placement.
 - 2. Store in manner to prevent excessive rusting and fouling with grease, dirt, or other bond-weakening coatings.
 - 3. Take precautions to maintain identification after bundles are broken.
- C. Cast-in-Place Concrete:
 - 1. Store bulk cement in bins capable of preventing exposure to moisture.
 - 2. Use sacked cement in chronological order of delivery.
 - a. Store each shipment so that it may be readily distinguishable from other shipments.

1.06 PROJECT CONDITIONS

- A. Sequencing Schedule for Formwork:
 - 1. Ensure timely delivery of embedded items.
 - 2. Be responsible for cutting and patching necessitated by failure to place embedded items.
 - 3. Plan erection and removal to permit proper sequence of concrete placing without damage to concrete.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Formwork and Accessories:
 - 1. Forming Materials:
 - a. Panel or board forms at Contractor's option.
 - 1) Panel Forms:
 - a) Minimum 5/8 inch thick exterior grade plywood with sealed edges, PS 1 grade Plyform Class I and II B-B Exterior or HDO Exterior.
 - 2. Wood Framing:
 - a. WCLIB standard grade or better Douglas Fir.
 - 3. Form Ties and Spreaders:
 - a. Metal type acting as spreaders, leaving no metal within one inch of concrete face and no fractures, spalls, depressions or other surface disfigurations greater than 3/4 inch in diameter.
 - 4. Expansion Joint Filler:
 - a. Fiber Type:
 - 1) Premolded non-extruding preformed bituminous saturated fiberboard units, ASTM D 1751, 1/4 inch thick unless otherwise noted.
 - 2) Provide one of following, or approved equal:
 - a) W. R. Meadows, Inc. - Sealtight Fibre Expansion Joint (Basis-of-Design)
 - b) J.D. Russell Company – Fiberflex Fiber Expansion Joint
 - c) Right / Pointe Company – Fibre Expansion Joint
 - d) SpecChem Fiber Expansion Joint
 - b. Cork Type:
 - 1) Preformed cork, ASTM D1752, Type II, 1/2-inch size unless otherwise noted.
 - a) Right / Pointe Company – Cork-Standard Expansion Joint, or approved equal.
 - 5. Form Release Agent:
 - a. Must not stain or otherwise adversely affect architectural concrete surfaces.
 - b. Provide one of following, or approved equal:
 - 1) Atlas Construction Supply, Inc. – Atlas Premium Gold Release
 - 2) Nox-Crete Co. – Nox-Crete Form Coating
 - 3) Right / Pointe Company – Right Release Water Base
- B. Under Slab Moisture Barrier/Retarder:
 - 1. Vapor Retarder:
 - a. Minimum 15 mil thick, complying with ASTM E 1745, Class A and following:
 - 1) Water Vapor Permeance, ASTM F 1249 / E 154, Section 7: 0.01 perms or less.
 - 2) Puncture Resistance, ASTM D 1709: Minimum 2266 grams.
 - 3) Tensile Strength, ASTM D 882: 70.6 lbf/in
 - 4) Methane Transmission Rate, ASTM D 1434: 192.8 GTR mL(STP)/m²/day.
 - 2. Provide one of following products, or approved equal:
 - a. Moistop Ultra 15 by Fortifiber Building Systems Group.

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- b. VaporBlock 15 by Raven Industries, Inc.
 - c. Stego Wrap Vapor Barrier by Stego Industries, LLC
- C. Reinforcing:
 - 1. Bars:
 - a. New billet steel, ASTM A615 Grade 60, and ASTM A706.
 - 1) Grade 60, where welded.
 - 2) Refer to Structural Drawings for use of Grade 40 bars.
 - 2. Tie Wires and Spirals: ASTM A 1064.
 - 3. Bar Supports:
 - a. As required for assembling and supporting reinforcement in place.
 - b. Typical: CRSI Class B, pregalvanized.
 - c. Concrete adobes for foundations and slabs on grade.
- D. Concrete:
 - 1. General Requirements:
 - a. Furnish cement and aggregates with proven history of successful use with one another.
 - 1) Sources of cement and aggregate are to remain unchanged throughout Work, unless Architect approves request for change made at least 10 days prior to anticipated date of casting.
 - b. Ready-mixed concrete meeting requirements of ASTM C 94.
 - c. Deviations in properties of materials tested by Owner's Testing Agency is cause for their rejection pending additional test results and redesign of mix by Contractor's Testing Laboratory.
 - d. Use of frozen aggregates is not permitted.
 - 2. Cement:
 - a. Conforming to ASTM C150, Type II / V, low alkali.
 - b. Use one brand of cement throughout Project, unless otherwise acceptable to Architect.
 - 3. Aggregates:
 - a. Conform to Chapter 19A, Concrete, CCR, Title 24, Part 2 CBC Sections 1705A.3.2, 1903A.5, and following:
 - b. Coarse Aggregate:
 - 1) Conforming to ASTM C 33.
 - 2) Consisting of clean, hard, fine grained, sound crushed rock, or washed gravel, or combination of both.
 - 3) Free from oil, organic matter or other deleterious substances and not contain more than two percent by weight of shale or cherty material.
 - c. Fines:
 - 1) Conforming to ASTM C 33.
 - 2) Sand Equivalent:
 - a) Not less than 75 when tested per ASTM D 2419.
 - d. Provide aggregates from single source for exposed concrete.
- E. Water:
 - 1. Clean and potable, free from impurities detrimental to concrete.
- F. Admixtures:
 - 1. Use of admixtures is not permitted unless request is submitted to Architect and Structural Engineer for review and Structural Engineer's approval.
 - 2. Use of calcium chloride or admixtures containing calcium chloride is prohibited.

3. Upon receipt of Structural Engineer approval, Contractor modifies mix designs as necessary, and submits modifications to Owner's Testing Agency for testing and acceptance
 4. When approved, following types of admixtures may be used, conforming to manufacturer's recommendations for use:
 - a. Water Reducing: Conforming to ASTM C 494, Type A.
 - b. Accelerating or Retarding: Conforming to ASTM C 494
 - c. Air Entraining: Conforming to ASTM C 260.
 5. Do not use admixtures which have not been incorporated and tested in accepted mix designs.
- G. Fly Ash:
1. Fly ash conforming to ASTM C 618, Class N or F may be used at Contractor's option.
 - a. Use of Class C is not permitted.
 2. Do not substitute more than 15 percent by weight of fly ash or other pozzolan, for ASTM C 150, Portland Cement.
- H. Non-Shrink, Non-Metallic Grout:
1. Premixed high strength grout requiring only addition of water at Project Site.
 - a. BASF Corporation, Construction Chemicals – MasterFlow 928
 - b. Five Star Products, Inc. – Five Star Grout.
 - c. Sika Corporation – SikaGrout 428 FS
- I. Curing Materials:
1. Concrete Curing Paper:
 - a. Conforming to ASTM C 171, non-staining, reinforced type.
 - 1) Orange Label Sisalkraft by Fortifiber Building Systems Group.
 - 2) Approved equal.
 2. Liquid Curing Compound:
 - a. Conforming to ASTM C 309, Type 1, Class B, approved standard product resin type.
 - 1) Deliver in unopened labeled containers.
 - 2) Water based acrylic polymer blend, free of wax or oil, compatible with subsequent applied finishes or floor coverings.
 - 3) Do not apply curing compounds in areas designated to receive floor coverings.
- J. Joint Sealing Compound:
1. Refer to Section 07 9200.

2.02 SOURCE QUALITY CONTROL

- A. Furnish Plywood bearing APA grade-trademark.
- B. Owner's Testing Agency will:
1. Review mix designs, certificates of compliance, and samples of materials Contractor proposes to use.
 2. Test and inspect materials, as necessary, in accordance with ACI 318 and CBC Sections 1705A, 1903A, and 1910A for compliance with requirements.
 3. Take samples as required from Contractor's designated sources.

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4. Take one grab sample for each 100 tons of Portland cement except that, when used in bulk loading ready-mix plants where separate bins for pretested cement are not available, take grab samples for each shipment of cement placed in bin with not less than one sample being taken for each day's pour and subsequently test such samples when required by Architect who may be so advised by DSA.
 5. Test coarse, intermediate, and fine aggregate by use of solution of sodium or magnesium sulfate, or both whenever in judgment of Architect such tests are necessary to determine quality of material.
 - a. Perform such tests in accordance with ASTM C 88.
 - b. Loss not to exceed 6 percent of either fine intermediate or coarse aggregate.
 - c. Aggregate failing to comply with this requirement may be used in Work provided it contains less than 2 percent of shale and other deleterious particles and shows loss in soundness test of not more than 10 percent when tested in sodium sulphate solution.
 - d. Test aggregates as required by CBC Sections 1705A.3.2 and 1903A.5.
 6. Test for sand equivalent of fine aggregate in accordance with California Test 217.
 7. Test for cleanness value of coarse and intermediate aggregate in accordance with California Test 227.
 8. Inspect plant prior to starting Work to verify following:
 - a. Plant is equipped with approved metering devices for determining moisture content of fine aggregate.
 - b. Other plant quality controls are adequate.
 9. Continuously inspect quality and quantity of materials used in transit mixed concrete, in batched aggregates and ready-mixed concrete at mixing plant or other location per CBC Sections 1705A.3, 1905A.1.16, 1910A.1, and ACI 318 Section 26.12 as modified, where other materials are measured.
- C. Waiver of Batch Plant Inspection:
1. Continuous batch plant inspection may be waived in accordance with CBC Section 1705A.3.3.1
 2. Following requirements apply when batch plant inspection is waived:
 - a. Qualified technician of Testing Agency to perform check of first batch at start of day.
 - b. Licensed weighmaster to positively identify materials as to quantity and certify to each load by batch ticket.
 - c. Batch tickets, including material quantities and weights, are to:
 - 1) Accompany load
 - 2) Be transmitted to Project Inspector by truck driver with load identified thereon.
 - 3) Do not place load without batch ticket identifying mix.
 - 4) Inspector will keep daily record of placements, identifying each truck, its load, time of receipt, and approximate location of deposit in structure, and will transmit copy of daily record to enforcement agency.

2.03 MIXES

- A. General Requirements:
1. Perform tests or assemble necessary data indicating conformance with Specifications.

2. For each mix submit data showing that proposed mix will attain required strength in accordance with requirements of CBC Sections 1705A.3 and 1905A.1.16 per ACI 318 Section 26.12.2 (a) as modified
 3. Instruct Laboratory to base mix design on use of materials tested and approved by Owner's Testing Agency.
 4. Include compression strength test reports with mix design per CBC Section 1904A and 1905A.1.9
 5. Design Mix, test, and adjust when necessary in ample time before first concrete is scheduled to be placed.
 - a. Submit laboratory data and strength test results for revised mix design to Architect prior to using Mix in Project.
 6. Ensure mix designs will produce concrete to strengths specified and of uniform density without segregation.
 7. When mix yield exceeds 1-cubic yard, modify mix design to no more than one cubic yard without changing cement content.
 8. Contractor's mix designs are subject to review by Architect and Owner's Testing Agency.
 9. Introduction of calcium chloride will not be permitted.
 10. Water/Cement Ratio: 0.45 maximum, unless noted otherwise on Structural Drawings.
- B. Admixtures:
1. Where use of admixtures has been approved, provide admixtures produced by establish reputable manufacturers.
 - a. Conform to types of admixtures specified under "Materials" Article.
 - b. Use in compliance with manufacturer's printed directions.
 - c. Do not use admixtures which have not been incorporated and tested in accepted mix designs.
 - d. Refer to CBC Section 1903A.6 and ACI 318 Section 26.4.2.2(b) as modified.
- C. Patching Mortar:
1. Mix in proportions by volume of one part cement to two parts fine sand.
- D. Non-Shrink, Non-Metallic Grout:
1. Follow approved manufacturer's printed instructions and recommendations.

2.04 MIXING

- A. Batching Plant Conditions:
1. Ensure equipment and plant will afford accurate weighing, minimize segregation and will efficiently handle materials to satisfaction of Architect and Owner's Testing Agency.
 2. Use approved moisture meter capable of determining moisture content of sand.
- B. General Requirements:
1. Thoroughly clean concrete equipment before use for architectural concrete mixes to avoid contamination.
 2. Mix cement, fine and coarse aggregates, admixtures and water to exact proportions of mix designs.
 - a. Use method of mixing complying with ACI 318, Section 26.4
 3. Measure fine and coarse aggregates separately according to approved method which provides accurate control and easy checking.

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4. Adjust grading to improve workability; do not add water unless otherwise directed.
 5. Maintain proportions, values, or factors of approved mixes throughout Work.
 6. Mix concrete in transit mixers five minutes immediately prior to discharge in addition to mixing as called for by ACI 304 and ASTM C 94.
- C. Admixtures:
1. Use automatic metering dispenser to introduce admixture into mix.
 2. Use Dispenser recommended and calibrated by admixture manufacturer.

2.05 FINISH MATERIALS

- A. General:
1. Provide concrete sealer materials complying with requirements of SCAQMD Rule 1113.
- B. Concrete Sealer:
1. Lithium-Silicate sealer, hardener, and densifier.
 2. Use for concrete slabs where indicated in Finish Schedule:
 3. Products:
 - a. Subject to compliance with specified requirements, provide following, or approved equal:
 - 1) Conslideck LS by Prosoco, Inc.
 - b. Comply with SCAQMD Rule 1113 and requirements for low-emitting materials as specified in Section 01 3329.
 - c. Comply with ANSI/NFSI B101.3 for slip-resistance.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas where formwork will be constructed and verify that:
1. Excavations are sufficient to permit placement, inspection, and removal of forms.
 2. Excavations for earth forms have been neatly and accurately cut.
 3. Conditions are otherwise proper for formwork construction.
 4. Do not start Work until unsatisfactory conditions have been corrected.
- B. Examine units of Work to be cast and verify that:
1. Construction of formwork is complete.
 2. Required reinforcement, inserts, and embedded items are in place.
 3. Form ties at construction joints are tight.
 4. Concrete-receiving places are free of debris.
 5. Depths of depressed slab conditions are correct for delayed finish noted and for its proper bonding to concrete.
 6. Conveying equipment is clean and properly operating.
 7. Architect has reviewed formwork and reinforcing steel and that preparations have been checked with Project Inspector.
- C. Do not begin placement of concrete before unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Obtain necessary information for coordination of formwork with items to be embedded in concrete and other related work.
- B. Ensure availability of sufficient labor, equipment and materials to place concrete correctly in accordance with scheduled casting.
- C. Protect finished surfaces adjacent to concrete-receiving places.
- D. Clean transportation and handling equipment at frequent intervals and flush thoroughly with water before each day's run.
 - 1. Do not discharge wash water into concrete form.
- E. Construction Joints:
 - 1. Clean and roughen construction joint contact surfaces by removing surface laitance and exposing sound mortar.
 - 2. Sandblasting and bush-hammering are acceptable methods.

3.03 FORMWORK CONSTRUCTION

- A. General:
 - 1. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until concrete structure can support such loads.
 - a. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
 - b. Maintain formwork construction tolerances complying with ACI 347.
 - 2. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb Work in finished structures.
 - a. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in Work.
 - b. Use selected materials to obtain required finishes.
 - c. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
 - 3. Frame openings where indicated on Architectural, Structural, Mechanical, Plumbing and Electrical Drawings.
- B. Earth Forms:
 - 1. Construct wood edge strips at top sides of excavations.
 - 2. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.
 - 3. Remove loose dirt and debris prior to concrete pours.
 - 4. Foundation concrete may be placed directly into neat excavations provided foundation trench walls are stable as determined by Geotechnical Engineer, subject to approval of DSA.
 - a. In such case, minimum formwork shown on Drawings is mandatory to insure clean excavations immediately prior to and during placing of concrete.
 - b. Refer to Structural Drawings for footing requirements where footings are not formed.

- C. Formed Elements:
 - 1. Carefully align inside and outside forms before tightening ties.
 - 2. Plywood Forms:
 - a. Insure vertical joints are plumb and horizontal joints are level; arrange joints and ties in geometrical pattern as approved by Architect.
 - 3. Form inside corners at exposed conditions with mitered boards or plywood so that no concrete is placed against form ends.
 - 4. After erection, seal cracks, holes, slits, gaps, and apertures in forms so that they will withstand the pressure and will remain completely watertight.
 - 5. Provide means to seal bottom of forms at construction joints such as foam tape or other gasket devices.
 - 6. Apply coating of release agent prior to erection of formwork following approved manufacturer's recommendations.
- D. Expansion Joints:
 - 1. Provide in exterior concrete on grade at maximum 24 feet on center or as noted and at intersections with vertical surfaces, curbs, manholes or other penetrations through slabs.
 - 2. Use fiber type expansion joint fillers typically and depress 1/4 inch unless otherwise noted.
 - 3. Use cork type expansion joint fillers at conditions with non-bituminous waterproofing, liquid waterproofing, or sealant systems.
- E. Construction Joints:
 - 1. Provide where shown on Drawings as directed by Architect and per ACI 318, Section 26.5.6.
 - 2. Provide key indentations at joints.
 - 3. Provide pour strips on inside face of forms at horizontal joints, but remove strips and thoroughly clean out reglets before placing subsequent portions of wall.
 - 4. Prevent formations of shoulders and ledges.
 - 5. Provide means for drawing forms into firm contact with concrete before placing additional concrete over previous pours where shrinking and warping has separated concrete from forms.
- F. Embedded Items:
 - 1. Properly locate, unless locating is specified elsewhere, and place inserts and embedded items required by other trades prior to casting concrete.

3.04 REINFORCING PLACEMENT

- A. General:
 - 1. Place bars as noted.
 - 2. Reinforcement to be continuous.
 - a. Refer to Structural Drawings for lap splice schedule.
 - b. Stagger splices where possible.
 - c. Securely wire contact lap splices together to maintain alignment.
 - 3. Ensure placement will permit concrete protection in conformance with CRSI or to extent shown.
 - 4. Support and fasten bars securely with spacers, chairs or ties to permit their being walked upon without displacement or movement both before and during placement of concrete.

- a. Wire-tie bar intersections.
- 5. Do not bend bars around openings or sleeves.
 - a. Wherever conduits, piping, inserts, or sleeves, and like items interfere with placing of reinforcement, obtain Architect's approval of placing before concreting.
- 6. Do not field bend bars unless expressly noted in Contract Documents.
- B. Prior to placing concrete, verify reinforcement has been bent, positioned, and secured in accordance with Drawings; ensure removal of oil, grease, dirt, or other bond-weakening coatings; replace severely rust-pitted reinforcing bars.
- C. Quality Assurance:
 - 1. Project Inspector will inspect placement of reinforcement and notify Structural Engineer of discrepancies in placement.
 - 2. Owner's Testing Agency will inspect shop and field welding of reinforcing bars in accordance with CBC Section 1903A.8; 1705A.3.1 - Table 1705A.3, Item 2 and Table 1705A.2.1, Item 5b

3.05 CONCRETE PLACEMENT

- A. Notify Project Inspector, Architect, Structural Engineer, Testing Laboratory and DSA at least 48 hours before placing concrete.
- B. Place concrete in accordance with CBC Section 1705A and ACI 318.
- C. Place concrete in cycles as continuous operation to permit proper and thorough integration and to complete scheduled placement.
 - 1. Do not place concrete where sun, wind, heat, or facilities prevent proper finishing and curing.
- D. Convey concrete as rapidly and directly as practicable to preserve quality and to prevent separation from re-handling and flowing.
 - 1. Do not deposit concrete initially set.
 - 2. Place concrete within ninety minutes after adding water unless otherwise noted.
 - 3. Re-tempering of concrete which has partially set will not be permitted.
- E. Take precautions to avoid damage to under-slab moisture barrier and displacement of reinforcement and formwork.
- F. Deposit concrete vertically in its final position.
 - 1. Avoid free falls in excess of six feet where reinforcement will cause segregation and in typical conditions unless Architect approves otherwise.
- G. Keep forms and reinforcement clean above pour line by removing clinging concrete with wire brush before placing next lift.
 - 1. Remove leakage through forms.
- H. Interruption in placement longer than 60-minutes will be cause for discontinuing placement for remainder of day.
 - 1. In this event, cut back concrete and provide construction joints as Architect directs
 - 2. Clean forms and reinforcement as necessary to receive concrete at later time.

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- I. Hot Weather Concreting:
 - 1. Conform to ACI 305 and following requirements when mean daily temperature rises above 75 degrees F.
 - 2. Establish upper temperature limit of concrete mixes for each class of concrete.
 - a. Ensure that concrete temperature during placing are not so high as to cause difficulty from loss of slump, flash set, or cold joints, and do not exceed 90 degrees F.
 - b. Consider other project climatic conditions detrimental to concrete quality such as relative humidity, wind velocity, and solar radiation.
 - 3. Make trial batches of concrete for each mix design at limiting mix temperature selected.
 - a. In lieu of trial batches, submit compression strength test reports (20 minimum) at limiting temperature for each proposed mix to Owners testing laboratory for review.
 - 4. Employ practices to maintain concrete below maximum limiting temperature in accordance with ACI 305.
 - a. Concrete ingredients may be cooled before mixing, or flake ice or well-crushed ice of size that will melt completely during mixing may be substituted for part of mixing water.
 - 5. Employ practices to avoid potential problems of hot weather concreting in accordance with ACI 305.
 - 6. When temperature of reinforcing steel or steel deck forms is greater than 120 degrees F, spray reinforcing and forms with water just prior to placing concrete.
- J. Cold Weather Concreting:
 - 1. No placement of concrete will be allowed at temperatures below 20 degrees Fahrenheit or when mean daily temperature for curing period is anticipated to be below 20 degrees Fahrenheit.
 - 2. No concrete placement will be allowed on frozen sub-grade.
 - 3. Conform to ACI 306 and following requirements when mean daily temperature falls below 40 degrees Fahrenheit.
 - a. Ensure that reinforcement, forms, or ground to receive concrete are completely free from frost.
 - b. Temperature of concrete at time of placement for footings not to be lower than 50 degrees Fahrenheit.
 - 1) Minimum temperature at time of placement for other concrete to be 60 degrees Fahrenheit.
 - 2) Maximum temperature at time of placement to be 90 degrees Fahrenheit.
 - c. Maintain concrete at temperature no lower than 50 degrees Fahrenheit for minimum 7 day period after placement by means of blanket insulation, heaters, or other methods as approved by Architect.
 - d. Keep record of concrete surface temperature for first 7 days after each pour.
 - 1) Make Record open to inspection by Architect.
- K. Consolidating:
 - 1. Use vibrators for thorough consolidation of concrete.
 - 2. Provide vibrators for each location during simultaneous placing to ensure timely consolidation around reinforcement, embedded items and into corners of forms; ensure availability of spare vibrators in case of failures.
 - a. Vibrate through full depth of freshly placed concrete.

3. Do not place vibrators against reinforcement, attach to forms, or use to spread concrete.
 4. Exposed Concrete:
 - a. Vibrate with rubber type heads and, in addition, spade along forms with flat strap or plate.
- L. Construction Joints:
1. Verify location and conformance with typical details
 - a. Provide only where designated or approved by Architect.
 - b. Comply with ACI 318, Section 26.5.6
 2. Horizontal and vertical construction joints to be thoroughly sandblasted to clean and roughen entire surface to minimum 1/4-inch relief exposing clean coarse aggregate solidly embedded in mortar matrix.
 3. Just prior to depositing concrete, wet surface of construction joint thoroughly.
- M. Contraction (Control) Joints in Slabs-on-Grade:
1. Construct contraction joints in slabs-on-ground to form panels of patterns indicated on Shop Drawings.
 - a. Use saw cuts 1/8 inch x 1/4 slab depth, unless otherwise indicated.
 2. Time saw cutting to allow sufficient curing of concrete to prevent raveled or broken edges.
 3. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate, maximum 24 hours after pouring.
 4. When joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible; at column centerlines, half bays, third-bays
- N. Formed Elements:
1. Space points of deposit to eliminate need for lateral flow.
 - a. Placing procedures of concrete in forms permitting escape of mortar, or flow of concrete itself, will not be permitted.
 2. Level top surface upon stopping Work.
 3. Take special care to fill each part of forms by depositing concrete directly as near final position as possible, and to force concrete under and around reinforcement, embedded items, without displacement.
 4. After concrete has taken its initial set, exercise care to avoid jarring forms or placing strain on ends of projecting reinforcement.

3.06 CURING

- A. General Requirements:
1. Deploy curing measures immediately after placement and for measures other than application of curing compound, extend for seven days.
 - a. Architect may recommend longer periods based upon prevailing temperature, wind and relative humidity.
 - b. Comply with ACI 318, Section 26.5.3.
 2. Avoid alternate wetting and drying and fluctuations of concrete temperature.
 3. Protect fresh concrete from direct rays of sun, rain, freezing, drying winds, soiling, and damage.
 4. Do not permit curing method to affect adversely finishes or treatments applied to finish concrete.

- B. Curing Method, Typical:
 - 1. Keep forms and concrete surfaces moist during period forms are required to remain in place.
 - 2. Obtain Architect's approval of alternate measures.

3.07 FORM REMOVAL

- A. Secure Architect's approval for time and sequence of form removal.
- B. Form Removal:
 - 1. Remove forms carefully to avoid damaging corners and edges of exposed concrete.
 - 2. Remove forms after concrete has developed sufficient strength to sustain its own weight and superimposed loads.
 - a. Present results of 7 day test cylinder break to Architect to demonstrate compliance with above specified strength requirements prior to form removal.
 - b. Where 7 day test cylinder break demonstrates strength that is less than that specified, Contractor may elect to take additional cylinders at time of next pour to demonstrate strength requirements.
 - c. Cost of taking and testing additional sample will be borne by Contractor.
- C. Reuse of Forms:
 - 1. Architect will approve reuse of forms provided they are straight, clean, free from nails, dirt, hardened concrete, or other injurious matter and edges and surfaces are in good condition.
 - 2. Clean and repair damage caused by placing, removal, or storage.
 - a. Reuse of formwork with repairs or patches which would result in adverse effects to architectural concrete finish will not be permitted.
 - 3. Store formwork in manner to prevent damage or distortion.
 - 4. Reseal as required to achieve concrete of specified quality.
 - a. Form Sealer:
 - 1) Pre-Form 100 by Nox-Crete Products Group, Omaha, NE, or approved equal.

3.08 CLEANING, PATCHING, AND DEFECTIVE WORK

- A. Where concrete is under strength, out of line, level or plumb, or shows objectionable cracks, honeycombing, rock pockets, voids, spalling, exposed reinforcement, signs of freezing, or is otherwise defective, and, in Architect's judgment, these defects impair proper strength or appearance of Work, Architect will require its removal and replacement at Contractor's expense.
- B. Immediately after stripping and before concrete is thoroughly dry, patch minor defects, form-tie holes, honeycombed areas, and similar areas, with patching mortar.
 - 1. Install patch to match finish of adjacent surface unless otherwise noted.
 - 2. Remove ledges and bulges.
- C. Compact mortar into place and neatly file defective surfaces to produce level, true planes.
 - 1. After initial set, dress surfaces of patches mechanically or manually to obtain same texture as surrounding surfaces.

- D. Rock Pockets:
 - 1. Cut out to full solid surface and form key.
 - 2. Thoroughly wet before placing mortar.
 - 3. Where Architect deems rock pocket too large for satisfactory mortar patching as described, cut out defective section to solid surface, key and pack solid with concrete to produce firm bond and match adjacent surface.
- E. Cleaning
 - 1. Ensure removal of bituminous materials, form release agents, bond breakers, curing compounds when permitted, and other materials employed in concrete work which would otherwise prevent proper application of sealants, liquid waterproofing, and other delayed finishes and treatments.
 - 2. Where cleaning is required, take care not to damage surrounding surfaces or leave residue from cleaning agents.

3.09 CONCRETE SLAB FINISHES

- A. General:
 - 1. Comply with recommendations in ACI 302.1 R for screeding, restraighening, and finishing operations for concrete surfaces.
 - 2. Do not wet concrete surfaces.
- B. Broom Finish:
 - 1. Light Textured Broom Finish:
 - a. Provide light texture by drawing soft bristle broom lightly across concrete surface in one directions, as indicated on Drawings, to provide uniform fine line texture finish.

3.10 CONCRETE SEALER APPLICATION

- A. Apply specified sealer only to concrete surfaces where scheduled in Finish Schedule.
- B. Apply sealer only to surfaces that are sound, properly troweled and finished, and that are clean, dry, and free of form release agents, retarders, alkali, curing compounds, oil, grease and other contaminants.
 - 1. Acid-clean and etch discolored or stained slabs before sealer is applied when, in Architect's judgment, satisfactory uniform finish cannot be otherwise achieved.
- C. Apply Sealer to concrete slab indicated to lhave light broom finish.

3.11 CLEANING

- A. Perform Work to keep affected portions of Project Site neat, clean, and orderly.
 - 1. Remove, immediately upon completion of Work, surplus materials, rubbish, and equipment associated with or used in performance.
 - 2. Be aware that failure to perform clean-up operations within 24 hours of notice by Architect will be considered adequate grounds for having work done by others at no added expense to Owner.

3.12 FIELD QUALITY CONTROL

- A. Owner's Testing Agency will:
 - 1. Perform testing in accordance with ACI 318 and CBC Section 1903A and 1905A.
 - 2. Review concrete mix designs.
 - 3. Inspect concrete and grout placement continuously.
 - 4. Test concrete to control slumps according to ASTM C143.
 - 5. Continuously monitor concrete temperature as it arrives on Project Site.
 - 6. Test concrete for required compressive strength in accordance with CBC Section 1705A.3 – Table 1705A.3, Item 6; 1905A.1.16; and ACI 318 – Section 26.12 as modified:
 - a. Make and cure three specimen cylinders according to ASTM C 31 for each 50 cubic yards, or fraction thereof, of each class poured at Project Site each day.
 - b. Retain one cylinder for 7 day test and two for 28-day test.
 - c. Number each cylinder 1A, 1B, 1C, 2A, 2B, 2C, and so on.
 - 1) Date each set; and keep accurate record of pour each set represents.
 - d. Transport specimen cylinders from Project to laboratory after cylinders have cured for 24 hours on Project Site.
 - e. Cover cylinders and keep at air temperatures between 60 and 80 degrees Fahrenheit.
 - f. Test specimen cylinders at age 7 days and age 28 days for specified strength according to ASTM C 39.
 - g. Base strength value on average of two cylinders taken for 28 day test.
 - 7. Test and inspect materials, as necessary, in accordance with ACI 318, MM Test Method 227 (Coarse and Intermediate Aggregates) and MM Test Method 217 (Fine Aggregates), for compliance with requirements specified in this Section.
- B. Submit ticket for each batch of concrete delivered to Project Site.
 - 1. Provide following information on Ticket:
 - a. Design mix number.
 - b. Signature or initials of ready mix representative.
 - c. Time of batching.
 - d. Weight of cement, aggregates, water and admixtures in each batch with maximum aggregate size.
 - e. Total volume of concrete in each batch.
 - f. Notation to indicate equipment was checked for contaminants prior to batching.
 - 2. Pay Owner's Testing Agency for taking core specimens of hardened structure and testing specimen according to ASTM C 88 and C 42 when laboratory tests of specimen cylinders show compressive strengths below specified minimum.

3.13 PROTECTION

- A. Protect concrete from injurious action of elements and defacement during construction operations.
- B. Protect exposed corners of concrete from traffic or use which will damage them.

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- C. Make provisions to keep exposed concrete free from laitance caused by spillage or leaking forms or other contaminants.
 - 1. Do not allow laitance to penetrate, stain, or harden on surfaces which have been textured.

END OF SECTION 03 3000

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SECTION 04 2200

CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Concrete Unit Masonry Work, including but not limited to:
 - a. Concrete Masonry Units.
 - b. Mortar and Grout
 - c. Installation of reinforcing steel furnished under Section 03 3000
 - d. Control Joints
 - e. Testing and Inspection.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 01 4500: Quality Control; testing laboratory services.
 - 3. Section 03 3000: Cast-in-Place Concrete; furnishing of reinforcing steel for masonry work and placing of dowels in concrete for start of masonry work.
 - 4. Section 07 1923: Water Repellent/Graffiti-Resistant Coatings
 - 5. Section 07 9200: Joint Sealants; sealant and backer rod for joints in concrete masonry.
 - 6. Section 09 2513: Portland Cement Plaster; applied over concrete unit masonry.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
 - 1. Chapter 21A - Masonry
- B. American Concrete Institute (ACI):
 - 1. ACI 315 – Manual of Standard Practice for Detailing Reinforced Concrete Structures.
 - 2. ACI 318 – Building Code Requirements for Structural Concrete.
 - 3. Building Code Requirements for Masonry Structures – TMS 402 / A530 / ASCE 5
 - 4. Specification for Masonry Structures – TMS 602 / ACI 530.1 / ASCE 6
- C. ASTM International (ASTM):
 - 1. ASTM C 90 – Standard Specification for Loadbearing Concrete Masonry Units
 - 2. ASTM C 94 – Standard Specification for Ready Mixed Concrete.
 - 3. ASTM C 140 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
 - 4. ASTM C 270 – Standard Specification for Mortar for Unit Masonry.
 - 5. ASTM C 426 – Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units
 - 6. ASTM C 476 – Standard Specification for Grout for Masonry

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's literature describing products, including mix designs, history of compression tests, and mixing requirements as they apply to each different masonry unit, accessory, and other manufactured product to be used in concrete unit masonry construction.
 - 2. Literature includes, but is not necessarily limited to, preformed rubber control joints and mortar and grout additives.
- B. Certificates:
 - 1. Material certificates for following signed by manufacturer and Contractor, certifying that each material complies with requirements designated:
 - a. Each material and grade of reinforcing bars, in accordance with requirements of Section 03 3000.
 - 1) Include mill test reports.
 - b. Each type and size of anchors, inserts, ties, and accessories.
 - 2. Certificate of compliance with standards designated.
 - 3. Plant certificates for concrete masonry units to Owner's Testing Agency, and Architect, stating that units have been properly cured before shipment and that they conform to requirements of these specifications, including but not necessarily limited to, requirements for moisture content per ASTM C 90 Type 1 units.
 - 4. Masonry units shipped without certification will be rejected.
- C. Mix Designs:
 - 1. For mortar and grout.
 - 2. Manufacturer's literature for grout admixtures
- D. Mill Test:
 - 1. Mill test reports for reinforcing steel.
- E. Extreme Weather Procedures:
 - 1. Cold and hot-weather construction procedures evidencing compliance with requirements specified in ACI 530.1 and these specifications.
- F. Shop Drawings:
 - 1. Coordination and shop drawings for concrete masonry unit walls consisting of elevations and sections indicating materials and assembly, color surface finish, courses, and reinforcing.
 - 2. Comply with following requirements:
 - a. Illustrate detailing, fabrication, bending and placement of unit masonry reinforcing bars.
 - b. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars and arrangements of masonry reinforcement.
 - c. Indicate location of conduit, plumbing, and other items embedded in unit masonry walls and coordinate this Work with placement of unit masonry reinforcement.
 - d. Provide shop drawings drawn to scale.

- G. Test Reports:
 - 1. Material test reports indicating and interpreting test results relative to compliance with tests described in "Quality Assurance" Article and "Field Quality Assurance" Article.
- H. Samples:
 - 1. Unit Samples:
 - a. Concrete masonry units of each color and texture specified.
 - 2. Accessories embedded in concrete masonry Work.

1.04 QUALITY ASSURANCE

- A. Concrete Unit Masonry Work:
 - 1. Comply with standards and requirements of above references.
 - 2. Where discrepancies exist between references and Contract Documents, comply with requirements of Contract Documents.
- B. Allowable Tolerances:
 - 1. Place concrete unit masonry within 1/8 inch of dimensions noted.
 - 2. Maximum Variation from Plumb of Walls: 1/8 inch in 20 feet.
 - 3. Provide joints with uniform thickness of 3/8 inch unless otherwise noted.
 - a. Joints Variation:
 - 1) Not more than 1/16 inch in adjacent courses within two feet and not less than 5/16 inch thick and not greater than 7/16 inch thick.
- C. Reinforcing Steel:
 - 1. Do not permit reinforcing steel to rust where there is danger of staining exposed surfaces of adjacent concrete.
 - 2. Replace rust-stained concrete and masonry at no additional expense to Owner or Project.
- D. Testing Laboratory Services:
 - 1. Laboratory Selection, Payment, and Reports:
 - a. Comply with requirements of Section 01 4500.
 - 2. Certificates and Reports:
 - a. Collect plant certificates from Contractor for concrete masonry units and mill test reports for reinforcing listed in "Submittals" Article
 - 3. Perform Following Tests:
 - a. Concrete Masonry Units:
 - 1) Sample and test in accordance with ASTM C90, C 140, and C 426
 - b. Portland Cement:
 - 1) Sample and test Portland cement or provide mill test reports, per Sections 01 4500 and 03 3000..
 - c. Mortar and Grout Tests:
 - 1) Comply with CBC, Part 2, Section 2105A.2.2.1.4
 - 2) Take minimum of one set of cylinders on each of first three days of masonry work and at least at one week intervals thereafter.
 - d. Mandatory Tests:
 - 1) Sample and test concrete masonry units for measurement of dimensions, compressive strength, and absorption in accordance with ASTM C140 as follows:
 - a) Section 6 – Measurement of Dimensions.
 - b) Section 7 – Compressive Strength.

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- c) Section 8 – Absorption.
 - 2) Compressive Strength Tests of Units:
 - a) Comply with CBC 2105A.2.2.1.2.
 - 4. Moisture Content and Drying Shrinkage Testing:
 - a. Conduct moisture content and linear shrinkage testing in accordance with ASTM C 426.
 - b. Maximum linear shrinkage of 0.065 percent from saturated to oven dry condition.
 - c. Provide Test Data that is traceable to units being supplied for Project, and complies with ASTM C 90, Section 8.3.
 - 5. Cores:
 - a. Perform core tests on sample concrete masonry Work and structure in accordance with CBC, Part 2, Chapter 21A, Section 2105A.4
 - b. Location of Cores in Structure:
 - 1) As approved by Architect and Division of the State Architect.
 - 6. Reinforcing Testing:
 - a. Sample and test reinforcing per Division 01 Sections and Section 03 3000.
 - 7. Field test masonry unit moisture content prior to concrete block installation.
 - a. Refer to "Field Quality Assurance" Article.
- E. Masonry Inspection:
- 1. Masonry work will be continuously inspected during laying by inspector specially approved for that purpose by Division of the State Architect.
 - 2. Cost of such inspection will be paid for by Owner.
- F. Comply with provisions of ACI 530 and 530.1, except where exceeded by requirements of Contract Documents.
- G. Mock-Up Panel:
- 1. Construct mock-up panel approximately 4 feet high by 6 feet long, including corner.
 - a. Do not proceed with masonry construction until sample panel is accepted by Architect.
 - 2. Use full size masonry units which have been selected and approved by Architect to show color range, maximum texture range, bond, mortar, tooling of joints and quality of workmanship in mock-up panel.
 - 3. Retain mock-up panel on Project Site for comparison purposes with actual concrete masonry work.
 - a. Mock-up panel may be part of Project and incorporated into wall system.
 - b. When mock-up panel is not part of wall system, demolish and remove from Project Site after completion and acceptance for Project concrete masonry Work.
- H. Examination Criteria:
- 1. Examination, selection, and approval are for purpose of achieving final installation of concrete unit masonry with greatest possible uniformity of appearance and structural integrity based on following criteria:
 - a. Conformance with testing and quality assurance measures as specified.
 - b. Color and texture matching per approved mock-up for range, random variation, and finish.
 - c. Conformance to Contract Documents and approved shop drawings within specified dimensions and tolerances.

- d. Other criteria as specified.
2. Non-conformance with above criteria is grounds for removal and replacement of Work at no cost to Owner.
3. Determination that Work complies with specified criteria will be made by Architect.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged material in original containers with seals unbroken and labels intact until time of use.
- B. Deliver concrete masonry units to Project Site, conforming to moisture requirements of ASTM C 90.
 1. Ensure that masonry units meet moisture requirements during laying of units and grouting until wall is complete.
- C. Unload and inspect each masonry unit carefully and store on raised platform protected from weather meeting ASTM C90 requirements at time of laying and grouting.
 1. Reject and remove from Project Site material not conforming to specification requirements.
 2. Reject concrete masonry units that are not in conformance with manufacturer's specifications:
 - a. Color or texture of concrete masonry units deviates from range of colors and textures of approved samples, as determined by Architect.
 - b. Concrete masonry units that are chipped, cracked, or otherwise damaged.
- D. Protect cementitious materials against exposure to moisture.
 1. Use of cementitious or other materials that have become caked and hardened from absorption of moisture is not permitted.
- E. Prior to installation, unload concrete masonry units onto working pallets as described in "Preparation" Article.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions:
 1. Do not place unit masonry when temperature is below 40 degrees F, unless Architect approves and Contractor provides means for preventing damage from freezing before and after placement.
- B. Protection:
 1. Protect surrounding Work as required against damage from masonry Work.
 2. Satisfactorily clean and correct damage to surrounding Work resulting from masonry Work.
 3. Conforming to Take necessary means and precautions to protect masonry units from moisture absorption during shipping, storage on Project Site, during placement prior to grouting of wall, and during wall construction, until masonry wall is completed and graffiti-resistant coating is applied.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General – Hollow Concrete Masonry Units:
 - 1. Provide concrete masonry units that have been air cured for not less than 28 days.
 - a. Size:
 - 1) Nominal 8 by 8 by 16 inches, except where otherwise indicated.
 - 2. Provide bond beam units at horizontal reinforcing.
 - 3. Compressive strength of Masonry (f'm) per Structural Drawings
 - 4. Provide concrete masonry units that have been air cured for not less than 28 days.
 - 5. Manufactured by one of following, or approved equal:
 - a. Angelus Block
 - b. Orco Block
- B. Smooth Face (Precision) Hollow Concrete Masonry Units:
 - 1. Conforming to ASTM C 90, medium weight (115 pcf):
 - a. Smooth face.
 - 2. Color: Gray
- C. Lintels for Concrete Masonry Units:
 - 1. General:
 - a. Conform to requirements for specified concrete masonry units.
 - 2. Reinforced concrete filled U-shaped concrete masonry units
 - 3. Design for load and span per Structural Drawings:
 - a. Reinforce with deformed steel bars.
 - b. Refer to Structural Drawings for quantity and size of reinforcing.
 - 4. Lintels for Exposed Masonry Work:
 - a. Match color and texture of masonry Work.
- D. Provide Concrete Masonry Units that have been air cured for not less than 28 days.

2.02 MORTAR AND GROUT MATERIALS

- A. Cement for Mortar and Grout:
 - 1. Type I or Type II Portland Cement conforming to ASTM C 150.
 - 2. Type II Portland Cement may be used only when it equals strength of Type I.
 - 3. Use low alkali (0.6 percent maximum) type cement for mortar and grout
- B. Sand:
 - 1. Conform to ASTM C 144, except with not less than 3 per cent of sand passing No. 100 sieve.
 - 2. Sand for Grout:
 - a. Conform to ASTM C 404.
- C. Pea Gravel:
 - 1. Conform to ASTM C 33.
 - 2. Size Range: No. 8 to 3/8 inch.
- D. Lime:
 - 1. Hydrated lime conforming to ASTM C 207, Type S

- E. Water:
 - 1. Clean, potable, and free from impurities detrimental to mortar and grout..
- F. Mortar Color Pigment:
 - 1. Davis Colors, Solomon Colors, or approved equal.
 - 2. Color: As selected by Architect.

2.03 MASONRY ACCESSORIES

- A. Reinforcing Bars:
 - 1. Bars:
 - a. New billet steel conforming to following:
 - 1) ASTM A615, Grade 60
 - 2) ASTM A706, Grade 60, where welded.
 - 2. Tie Wires: ASTM A82.
 - 3. Comply with requirements of Section 03 3000.
- B. Control Joints:
 - 1. Preformed rubber in profiles required or shown.
 - 2. Provide products by one of following, or approved equal:
 - a. RS Series by Hohmann & Barnard, Inc.
 - b. 2900 Series by Wire-Bond
- C. Additives and Admixtures:
 - 1. Required in grout to:
 - a. Reduce early water loss to masonry units.
 - b. Produce expansive action in plastic grout to offset initial shrinkage and promote bonding of grout to interior masonry unit surfaces.
 - 2. SikaGrout Aid by Sika Corporation, or approved equal.
 - 3. Add admixtures in accordance with admixture manufacturers instructions.
 - 4. Use of admixtures is not permitted unless request is submitted to Architect and Structural Engineer for review and Structural Engineer's approval.
 - 5. Do not use admixtures which have not been incorporated and tested in accepted mix designs.

2.04 MORTAR AND GROUT MIXES

- A. Mortar:
 - 1. CBC Chapter 21A, Section 2103A.8.
 - 2. Conform to ASTM C 270, Type S and Articles 2.1 and 2.6A of TMS 602/ACI 530.1/ASCE 6
 - a. Compressive Strength: Minimum 1,800 psi at 28 days.
 - 3. Mix in batch mechanical mixer permitting accurate control of water amounts.
 - a. Place approximately half of required water and sand into mixer while turning.
 - b. Add cement and remainder of sand and water into mixer in that order and mix materials for at least three minutes with minimum of water to produce workable consistency.
 - c. Site mixing of mortar is not permitted without review and acceptance of Contractor's procedure by Owner's Testing Agency and Structural Engineer.
 - 4. Add lime and continue mixing as long as required to secure uniform mass.
 - 5. Total mixing time may not be less than 3 minutes or more than 10 minutes.

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6. Place mortar in final position within 1 hour after mixing.
 - a. Re-tempering of mortar is not permitted.
 - b. Remove from Work mortar or grout which is unused within one hour after initial mixing.
- B. Grout:
 1. CBC Chapter 21 A, Section 2103A.13.
 2. Conform to Article 2.2 of TMS 602/ACI 530.1/ASCE 6
 - a. Compressive Strength: Minimum 2,000 psi at 28 days.
 3. Mix grout in accordance with ASTM C 94
 4. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
 - a. Per DSA IR 21-2.10:
 - 1) Grout mix complying with requirements of CBC Section 2103A.12.
 - 2) Solidly fill cells with grout in reinforced hollow unit masonry per CBC Section 2104A5.1.1.
 - 3) Use coarse grout in grout spaces 2 inches or more in width and in filled cells per CBC Section 2104A.5.
 - 4) Sufficient water may be added to make workable mix that will flow into masonry voids without separation or segregation.
 - 5) Grout Slump: 8 to 11 inches per TMS 602, Article 2.6 B.2 and ASTM C 476, Section 4.2.2.
 - 6) Provide grout mixes containing approved admixture conforming to specified requirements.
 - 7) Use approved admixture in strict accordance with manufacturer's instructions and appropriate listing from ICC-ES or other acceptable evaluation agency per IR A-5
 5. Use grout aid in grout to reduce early water loss to masonry units and produce expansive action in grout sufficient to offset initial shrinkage.
 - a. Mix grout admixture in accordance with manufacturer's recommendations and requirements.
 6. Use sufficient water to make workable mix that will flow into joints of masonry units with typical rates of absorption for ASTM C 90 Type I units.
- C. General Mixing Requirements:
 1. Measure materials accurately.
 2. Shovel measurements will not be permitted.
 3. Use mechanical mixer of at least one-sack capacity.
 4. Completely empty drum before charging succeeding batch of materials.
 5. Exercise extreme care in measuring ingredients for partial batches.
 6. Comply with mixing requirements of ACI 318.

2.05 SOURCE QUALITY CONTROL

- A. Source Limitations for Masonry Units:
 1. Obtain exposed masonry units of uniform texture and color, or uniform blend within ranges accepted for these characteristics, with units from same batch, through one source from single manufacturer.
 2. Use only one source for concrete masonry units throughout Work.

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine areas to receive masonry and verify following:
 - 1. Foundation surface is level to permit bed joint within range of 1/4 to 3/4 inch.
 - 2. Edge is true to line to permit projection of masonry to less than 1/4 inch.
 - 3. Projecting dowels are free from loose scale, dirt, concrete, or other bond-inhibiting substances and properly located.
- B. Do not begin before unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean concrete surfaces to receive masonry.
- B. Remove laitance or other foreign material lodged in surface by sandblasting or other means as required.
- C. Ensure masonry units are clean and free from dust, dirt, or other foreign materials before laying.
- D. Roughen concrete below walls to expose aggregate.
 - 1. Remove loose particles and in hot weather dampen concrete surfaces before laying blocks.
 - 2. Contact surfaces of foundations and floors that are to receive masonry work are to be mechanically roughened to 1/4 inch amplitude.
 - 3. Comply with ACI 318, Section 6.4.
- E. Ensure random color variations in installation of concrete masonry units.
 - 1. Unload from three delivered pallets onto working pallet to be used for construction.
 - 2. Alternate among pallets when unloading to ensure mix of concrete masonry units on working pallet.

3.03 REINFORCING

- A. General:
 - 1. Clean free of loose rust, mill scale, earth, or other materials which will reduce bond to mortar or grout.
 - 2. Shop fabricate to comply with Drawings.
 - 3. Conform to requirements of ACI 315 where specific details are not shown, or where Drawings and Specifications are not more restrictive.
 - 4. Do not use reinforcing bars with kinks or bends not shown on Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Place bars where noted in accordance with ACI 315 and CBC 2104A and do not disturb after start of masonry placement.
 - 1. Position reinforcing accurately at spacing shown.
 - 2. Support and secure vertical bars against displacement.

- a. Where vertical bars are shown in close proximity, provide clear distance between bars of not less than nominal bar diameter or 1 inch, whichever is greater.
 3. Horizontal reinforcing may be placed as masonry work progresses.
 - a. Lay horizontal reinforcing in bond beam units.
 4. Minimum clearance between bar and concrete masonry unit is 1/2 inch and between parallel bars is 1 inch.
 5. Horizontal and Vertical Reinforcing:
 - a. Hold in position by wire positioners or spacing devices near ends and at intervals not to exceed 200 bar diameters, and as required to prevent displacement by construction loads or placement of grout beyond tolerances allowed by CBC 2104A.
- C. Splice reinforcing bars where shown.
1. Do not splice at other points unless acceptable to Architect.
 2. Provide lapped splices, unless otherwise shown.
 3. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
 4. Provide not less than minimum lap shown, or where not shown, as required by governing code.
 5. Weld splices where shown.
 6. Comply with requirements of AWS D1.4 for welding materials and procedures and with Section 03 3000 for welded reinforcement.
- D. Completely embed bars in mortar or grout for joint reinforcement embedded in horizontal mortar joints
1. Provide not less than 5/8 inch mortar coverage on exterior face of walls and 1/2 inch at other locations.
 2. For other reinforcement provide minimum coverage of one bar diameter over bars, but not less than 3/4 inch except where exposed to weather or soil in which case provide minimum coverage of 2 inches.

3.04 PLACEMENT

- A. General Requirements:
1. Comply with CBC Section 2104A.
 2. Ensure masonry units are sound, clean and free of cracking, chipping and broken edges at time of placement.
 - a. Use double open-ended beam units, typical.
 - b. Use proper units to provide for windows, doors, bond beams, lintels, and pilaster, in order to minimize cutting.
 3. Accurately cut and fit units as required to accommodate other work using masonry saws.
 4. Lay masonry units plumb, true to line, with level courses accurately placed.
 5. Adjust unit to final position while mortar is soft and plastic.
 6. Align vertical cells accurately to provide continuous, unobstructed opening for grouting.
 7. Remove units disturbed after stiffening of mortar, clean joints, and relay unit with fresh mortar.
 8. In hot weather, moisten contact surfaces of masonry units to receive mortar immediately before laying to prevent excessive drying of mortar.
 9. Do not lay up one tier of wall more than 16 inches ahead of other tier.

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10. Where necessary to stop longitudinal run, rack back one-half block length in each course.
 11. Do not attach construction supports to walls, except where permitted by Architect.
 12. Install anchors, bolts, and other embedded items accurately as Work progresses and prior to grouting.
 13. Coordination:
 - a. Masonry Installer and Reinforcing Steel Installer: Meet and coordinate placement of reinforcing steel prior to placement of concrete or grout.
- B. Bond Pattern:
1. Running bond.
 2. Corners:
 - a. Provide standard masonry bond by overlapping units.
- C. Joints:
1. Maintain joint widths shown, except for minor variations required to maintain bond alignment.
 - a. Ensure full coverage of face shells in both horizontal and vertical joints and on webs.
 2. Where not otherwise indicated, lay walls with 3/8 inch joints.
 3. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials.
 4. Joints Exposed to Weather:
 - a. Tool exposed joints slightly concave to achieve solid, smooth, watertight, compacted joints, well bonded to masonry at edges.
 5. Rake out mortar in preparation for application of sealants where shown.
 6. Immediately fill holes made by line pin with mortar when pin is withdrawn.
 7. Remove surplus mortar from joints.
- D. Cold Weather Requirements:
1. When daily temperature is below 40 degrees F., ensure reinforcing, masonry units contacting mortar, and grout are free of frost.
 2. Protect mortar and grout from freezing for at least 48 hours after installation whenever temperature falls below 40 degrees F.
 3. Maintain mortar and grout at temperature no lower than 50 degrees F., while being used and until installed.
 4. In freezing or near freezing weather, provide equipment of adequate size for heating of mortar and grout.
 5. Do not add water to mix at temperature greater than 140 degrees F.
- E. Hot Weather Requirements:
1. Implement requirements of approved Hot Weather construction procedures when ambient air temperature exceeds 100 degrees F or 90 degrees F with wind velocity greater than 8 mph.
- F. Protection:
1. Protect face materials against staining.
 2. Remove misplaced grout or mortar immediately.
 3. Protect sills, ledges, offsets, and similar items from mortar drippings or other damage during construction.

G. Built-in Work:

1. As Work progresses, build-in items specified under this and other sections of these specifications.
 - a. Fill in solidly with masonry around built-in items.
 - b. Fill space between hollow metal frames and masonry solidly with mortar.
 - c. Solid grout hollow metal door frames where occurring in masonry construction.
2. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.
3. Install bolts, dowels, plates, anchors, hangers and like items where shown to be built into masonry for Work of other trades.
4. Install concrete masonry lintels where shown and following:
 - a. Minimum 8 inch bearing at each end of lintel.
 - b. Align end joints with coursing beyond jambs.

H. Requirements for Walls to be Grouted by High-Lift Method:

1. Lay up walls full story prior to grouting.
 - a. Brace walls adequately to resist wind lateral and other forces.
2. Build vertical grout barriers or dam of solid masonry across grout space at no more than 25 feet on centers to control horizontal flow of grout.
3. Provide cleanouts by leaving out every other unit in bottom course.
 - a. Seal after inspection and before grouting.
 - b. Allow 24 hour cure time for face shell plugs and adequately brace to resist grout pressure.
4. During laying up, remove mortar fins and other foreign matter from grout space with stick and compressed air.
5. Grout:
 - a. High slump workable mix placed by pumping.
6. Use mechanical vibrators for consolidation.
7. Grout is to be reconsolidated after it has taken on plastic consistency but prior to taking on initial set.
8. "Pour" is considered as entire height of grout fill placed in one day and is composed of number of successive placed grout lifts.
9. "Lift" is layer of grout placed in single continuous operation.
10. Maximum Height of Pour:
 - a. Twelve feet for eight inch walls
 - b. Sixteen feet for twelve inch walls.

3.05 GROUTING

- A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.
- B. Ensure vertical cells have proper vertical alignment, to maintain continuous unobstructed vertical cell area of 3 by 3 inches.
 1. Use grout that is sufficiently fluid to ensure complete filling of every section of units, but not so thin as to allow segregation of aggregate.
 2. Grout every cell.
- C. Water/Cement Ratio for Grout:
 1. Not more than 7-1/2 gallons of water per sack of cement.
- D. Provide grout pours in excess of 24 inch height with cleanouts.

- E. Maximum Lift of Grout Pour:
 - 1. 4 feet, unless high-lift method is used.
- F. When grouting is stopped for period of one hour or longer, form horizontal construction joints by stopping grout one inch below top of uppermost unit.
- G. Grouting of Steel Door Frames:
 - 1. Grout steel door frames where installed in masonry construction with grout specified in Article 2.02
- H. Low-Lift Grouting:
 - 1. Conform to CBC 2104A.5.1.2.2.
 - 2. Limit height of pours to 4 feet.
 - 3. Limit height of masonry to 16 inches above each pour.
 - 4. Pour grout only after vertical reinforcing is in place.
 - a. Place horizontal reinforcing as grout is poured.
 - b. Prevent displacement of bars as grout is poured.
 - 5. Place grout for each pour continuously and consolidate immediately.
 - a. Do not interrupt pours for more than 1-1/2 hours.
- I. When grouting is stopped for more than one hour, terminate grout minimum 1/2 inch, 2 inches maximum below top of upper masonry unit to form positive key for subsequent placement.
- J. Solid grout cells and courses – No Exceptions.
 - 1. Consolidate with 3/4 inch diameter mechanical vibrator inserted into each and every cell.

3.06 POINTING AND CLEANING

- A. Point holes or defective mortar joints upon completion of Work.
 - 1. Where necessary, cut out and repoint defective joints.
- B. At end of workday, fiber-brush new surfaces to remove mortar splashes.
 - 1. clean with mild detergent or enzymes, and rinse with clean water.
- C. Do not use acid solution to remove green stain or efflorescence resulting from salts.
 - 1. Follow recommendations of manufacturer for removal of such stains.
- D. Upon completion of Work, remove from Project Site, surplus materials, rubbish, and debris resulting from Work.

3.07 FIELD QUALITY ASSURANCE

- A. Special Inspections:
 - 1. Special Inspectors:
 - a. Prequalified and approved by DSA and employed by Owner to perform continuous masonry inspection per CBC 1701A.
 - 2. Masonry Inspector Requirements:
 - a. Present at Project Site during masonry construction and perform following duties:
 - 1) Review plans and specifications and meet with Contractor to discuss requirements before Work commences.

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- 2) Before masonry Work commences, hold joint meeting with Contractor and Architect to review requirements for surveillance and quality control of masonry Work.
 - 3) Check brand and type of cement, lime (when used), and source of sand.
 - 4) Inspect foundation or slab to ascertain that it is clean and ready to receive units.
 - 5) Check reinforcing steel dowels for straightness, proper alignment, spacing, size and length.
 - 6) Observe manner in which units are laid up to ensure that joints are full of mortar and kept tight during work.
 - a) Inspect cells to assure that fins will not interfere with grouting or foaming.
 - b) Instruct masons to keep cells clean of mortar droppings and inspect to determine compliance.
 - 7) Observe placing of grout continuously.
 - 8) Perform or supervise performance of required sampling and field-testing as specified.
 - 9) Keep complete record of inspection of work.
 - 10) Report daily to Owner's Representative progress of masonry inspection.
 - 11) Submit verified reports to DSA.
- B. Determine strength of masonry by unit strength method in accordance with CBC 2105A.2.2.1
- C. Mortar and Grout Testing: Test mortar and grout in accordance with ASTM C 780 (mortar) and ASTM C 404 (Grout)

END OF SECTION 04 2200

SECTION 05 0513

SHOP-APPLIED COATINGS FOR METAL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Factory applied high performance painted finishes for following:
 - a. Aluminum extrusions for:
 - 1) Aluminum wall louvers
 - b. Coil coated sheet:
 - 1) Aluminum sheet for metal flashing and trim.
 - 2) Galvanized steel sheet for metal roof panels.
 - 2. Factory applied high performance powder coating for aluminum louvers.
- B. Related Sections:
 - 1. Section 07 4113: Metal Roof Panels
 - 2. Section 07 6200: Sheet Metal Flashing and Trim; prefinished metal
 - 3. Section 09 9100: Painting; ferrous and galvanized metal
 - 4. Section 09 9600: High Performance Coatings; AESS and other exposed steel
- C. Related Requirements:
 - 1. Refer to respective Sections of Division 26 for
 - a. Prefinished electrical equipment.

1.02 REFERENCES

- A. National Association of Architectural Metal Manufacturers (NAAMM):
 - 1. AMP 500 – Metal Finishes Manual
- B. Aluminum Association (AA):
 - 1. CA-92 – Care of Aluminum
 - 2. DAF-45 – Designation System for Aluminum Finishes.
- C. American Architectural Manufacturers Association (AAMA):
 - 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 2604 – Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 4. AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- D. ASTM International (ASTM):
 - 1. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

2. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

1.03 QUALITY ASSURANCE

- A. Applicator Qualifications:
 1. Engage experienced applicator who has completed high performance coating system applications similar in material and extent to that indicated for this Project with record of successful in-service performance.
- B. Source Limitations:
 1. Obtain primers for each coating system from same manufacturer as finish coats.
- C. Coating Manufacturer Responsibilities:
 1. General – Responsible for quality control, including inspection and records of inspection.
 - a. Make available to Architect and Owner, upon request.
 2. Conduct periodic inspections of surface preparation and coating operations as necessary.
 3. Notify Architect should Contractor fail to meet one or more portions of specification.

1.04 SUBMITTALS

- A. Product Data:
 1. For each metal finish system specified; including primers.
 2. Material List:
 - a. Provide inclusive list of required coating materials.
 - 1) Indicate each material and cross-reference specific coating, finish system, and application.
 - 2) Identify each material by manufacturer's catalog number and coating material proposed for use.
 3. Manufacturer's Information:
 - a. Provide manufacturer's technical information, including instructions for handling, storing and applying each coating material proposed for use.
 4. Certification by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).
- B. Samples:
 1. Prepare samples on metal of same alloy and gage to be used for Work, for color and finish.
 2. Provide minimum 4 by 8 inch pieces, and 8 inch lengths of larger sizes as required to show finished Work.
 3. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected
- C. Qualification Data:
 1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience.
 2. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

- D. Quality Control Submittals:
 - 1. Certificates of Compliance:
 - a. Manufacturer's certification that finishes applied on Project components comply with referenced AAMA standards.

1.05 WARRANTIES

- A. Warranties for High Performance Pigmented Organic Coatings (PVDF):
 - 1. Special Finish Warranty:
 - a. Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period.
 - b. Furnish applicator's warranty providing coverage that coatings:
 - 1) Will not chip, crack or peel (lose adhesion).
 - a) Excludes minute fracturing which may occur in proper fabrication of building parts.
 - b) Will not chalk in excess of ASTM D4214 Number 8 rating, determined by procedure outlines in ASTM D 4214.
 - c) Will not change color more than five Delta-E Hunter units as determined by ASTM D 2244, Method 6.3.
 - d) Fading or color changes may not be uniform when surfaces are not equally exposed to sun and elements.
 - e) Mica and metallic coatings are exempt due to inability to accurately measure color; mica and metallic flakes reflect and scatter light in random patterns.
 - 2) Warranty does not include normal weathering.
 - c. Warranty Period:
 - 1) 10 years from date of Substantial Completion for Type A coating system.
 - 2) 20 years from date of Substantial Completion for Type B coating system.
 - 3) 5 years from date of Substantial Completion for Type C
 - 2. Jointly warrant completed high performance metal finishes by respective coating manufacturer and coating applicator to meet weathering tests and performance requirements as specified.
 - 3. Coating applicator must apply for coating warranty at time of application.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Products:
 - 1. High Performance Pigmented Organic Metal Finishes are based on following systems as manufactured by PPG Industries, or approved equal by Valspar:
 - a. Metal Finish Type A:
 - 1) High Performance Fluoropolymer Coating System for Extruded Aluminum.
 - 2) Manufacturer's standard 3 coat system, consisting of primer, color coat, and clear topcoat.
 - b. Metal Finish Type B:
 - 1) High Performance Fluoropolymer Coating System for Coil-Coated Steel Sheet.

- 2) Manufacturer's standard 2 coat system, consisting of nominal 0.2 mil corrosion inhibitive primer and 0.75 fluoropolymer color topcoat.
- B. Basis-of-Design Products:
1. High Performance Powder Coating on aluminum is based on products as manufactured by Tiger Drylac or approved equal:
 - a. Metal Finish Type C:
 - 1) High Performance Powder Coated Finish
- C. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
1. Submit items listed in "Submittals" Article and as specified in Section 01 3300, For evaluation of proposed system.
 2. Furnish documentation that tests have been made for identical systems within ranges of specified.
 3. Acceptance is also subject to availability of acceptable color matching specified color.
 4. Manufacturer's minimum 10 year finish and material warranty for Type A.
 5. Manufacturer's minimum 20 year finish and material warranty for Type B
 6. Manufacturer's minimum 5 year finish and material warranty for Type C

2.02 COATING MATERIALS – GENERAL

- A. Material Compatibility:
1. Provide primers and finish coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality:
1. Provide manufacturer's highest grade of various high performance coatings specified; of uniform color throughout and color-fast.
 2. Materials not displaying manufacturer's product identification are not acceptable.
- C. Coating Manufacturers and Coating Applicators:
1. Develop jointly methods and procedures for surface preparation, priming, and finish coating of materials.

2.03 HIGH-PERFORMANCE PIGMENTED ORGANIC COATING SYSTEMS

- A. High Performance Metal Finish Type A:
1. High performance pigmented organic coating, meeting or exceeding performance and test provisions of AAMA 2605 for ten years minimum and following requirements:
 - a. Minimum 70 percent PVDF (Kynar 500 or Hylar 5000) resin system base with pigmentation.
 - 1) Non-chalking, resistant to ultraviolet deterioration, of uniform color throughout, and colorfast.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces following coating and resin manufacturer's jointly developed methods and procedures for surface preparation, priming, and application of finish coating to entrance doors and frames and window materials.

2. Fluoropolymer Coating System:
 - a. Manufacturer's standard [2] [3] -coat thermo-cured system, consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin system base by weight complying with AAMA 2605.
 3. Shop apply Metal Finish Type A to aluminum components as follows:
 - a. Two Coat System:
 - 1) PPG Duranar Sunstorm Coating System consisting of:
 - a) Primer Coat: 0.2 to 0.3 mil dry film thickness.
 - b) Color Coat: 1.0 mil minimum dry film thickness.
 4. Color:
 - a. As selected by Architect from manufacturer's full line.
 5. Aluminum components to receive Metal Finish Type A:
 - a. Extruded Aluminum Wall Louvers.
- B. High Performance Metal Finish Type B:
1. High performance pigmented organic coating, meeting or exceeding performance and test provisions of AAMA 2605 for twenty years minimum and following requirements:
 - a. Minimum fluoropolymer 70 percent PVDF (Kynar 500 or Hylar 5000) resin system base by weight complying with AAMA 2605.
 - b. Provide 1 mil dry film thickness coating one side, 0.3 to 0.4 mil other side, or approved equal.
 - c. PPG Duranar Coil Coating System, or approved equal
 - d. Colors:
 - 1) As scheduled to match adjacent finishes.
- C. High Performance Metal Finish Type C:
1. Powdered polyester resin coating, electrostatically applied.
 2. High performance pigmented organic coating system, meeting or exceeding performance and test provisions of AAMA 2604 for five years minimum.
 3. Non-chalking, resistant to ultraviolet deterioration, of uniform color throughout, and colorfast.
 4. Coating manufacturer and applicator to develop jointly methods and procedures for preparation, priming, and finish coating of metal materials.
 5. Applicator: Licensed by powder manufacturer for application of specified coating.
 6. Product and Manufacturer:
 - a. Series 38 by Tiger Drylac, or approved equal.
 7. Color: As scheduled

2.04 PERFORMANCE REQUIREMENTS

- A. Provide factory applied metal finish systems suitable for application to aluminum extrusions and coil coated material.
- B. Conform to applicable performance standards where referenced in specification:

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Visible Surfaces of Exposed Work:
 - 1. Defined as surfaces which will be exposed to view from exterior and in interior of completed building.
- B. Perform finishing after fabrication, forming, fitting, and welding have been completed.
- C. Provide finishes on exposed Work that are uniform in appearance.
 - 1. Members are to match each other exactly throughout installed Work.
- D. Specified finishes establish type and quality required.
 - 1. Finishes are subject to Architect's acceptance.

3.02 CLEANING

- A. Comply with Section 01 7423 and following:
 - 1. Clean in accordance with coating manufacturer's recommendations.
 - 2. Do not use materials or methods which may damage finishes or surrounding
 - a. construction.

3.03 PROTECTION

- A. Protect finished surfaces from damage until acceptance by Owner.

END OF SECTION 05 0513

SECTION 05 1200

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Structural steel framing, including structural steel shown on Structural Drawings.
 - a. Standard shapes, plates and rods shown on Architectural, Mechanical, and Electrical Drawings that connect to building structure.
 - b. Welded stud connectors for composite construction, concrete engagement, and attachment of building components.
 - c. Anchor rods.
 - d. Bent plate deck closures.
 - e. Shop priming/painting and field touch-up of AESS and other exposed steel.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 03 3000: Cast-in-Place Concrete
 - 3. Section 04 2000: Concrete Unit Masonry
 - 4. Section 05 3000: Metal Decking
 - 5. Section 05 5000: Metal Fabrications
 - 6. Section 09 9600: High Performance coatings; field painting of exposed structural steel.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
 - 1. Chapter 22A - Steel
- B. ASTM International (ASTM):
 - 1. ASTM A 6 – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
 - 2. ASTM A 108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
 - 3. ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 4. ASTM A 153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 5. ASTM A 307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
 - 6. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - 7. ASTM A 435 – Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates
 - 8. ASTM A 490 – Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

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9. ASTM A 563 – Standard Specification for Carbon and Alloy Steel Nuts
 10. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 11. ASTM A 898 – Standard Specification for Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes
 12. ASTM B 695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
 13. ASTM F 436 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
 14. ASTM F 844 – Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
 15. ASTM F 959 – Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
 16. ASTM F 1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
 17. ASTM F 1852 – Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- C. American Institute of Steel Construction (AISC):
1. AISC 360 – Specification for Structural Steel Buildings.
 2. AISC 348 – Specification for Structural Joints Using ASTM A325 or A490 Bolts.
 3. AISC 303 – Code of Standard Practice for Steel Buildings and Bridges.
 - a. Provisions of AISC 303 do not effect change in duties and responsibilities of Owner, Contractor or Structural Engineer from those set forth in these Contract Documents.
 - b. Where discrepancies exist between requirements of Contract Documents and AISC 303, requirements of Contract Documents govern.
 4. AISC 341 – Seismic Provisions for Structural Steel Buildings, Including Supplement Number 1.
- D. American Welding Society (AWS):
1. AWS D1.1 – Structural Welding Code -- Steel.
 2. AWS D1.8 – Seismic Welding Supplement.
 3. AWS A2.4 – Standard Symbols for Welding, Brazing and Nondestructive Examination.
 4. AWS A5 – Filler Metal Specifications.
 5. AWS C4.1 – Criteria for Describing Oxygen-Cut Surfaces and Oxygen Cutting Surface Roughness Gauge.
 6. AWS QC1 – Standard for AWS Certification of Welding Inspectors.
- E. The American Society of Mechanical Engineers (ASME):
1. ASME B18.21.1 – Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series).
- F. The Society of Protective Coatings (SSPC):
1. SSPC-SP 1 – Solvent Cleaning.
 2. SSPC-SP 2 – Hand Tool Cleaning.
 3. SSPC-SP3 – Power Tool Cleaning.
 4. SSPC-SP6 – Commercial Blast Cleaning.

1.03 DEFINITIONS

- A. Gouge:
 - 1. Depression deeper than overall surface roughness.
- B. Quality Assurance Plan:
 - 1. Set of written requirements containing set of procedures that are to be followed by Owner's Testing Agency to confirm compliance with these requirements.
- C. Seismic-Load-Resisting System (SLRS):
 - 1. Defined as items designated "SLRS" on Structural Drawings, including columns, beams, and braces, and their connections along grid lines denoted "SLRS" on framing plans.
- D. Include following in accordance with requirements of Section 01 3300:
 - 1. Manufacturer's test reports and literature describing products, including but not necessarily limited to following, and excluding those listed in Article 1.06 B:
 - a. Manufacturer's Certifications for electrodes, fluxes and shielding gasses to be used.
 - 1) Certifications satisfying AWS A5 requirements.
 - 2) Certificate of Compliance from Contractor supplying materials.
 - 3) Certifications that product meets additional requirements of Project.
 - b. Manufacturer's product data sheets for welding material to be used.
 - 1) Data sheets describing product, limitations of use, recommended welding parameters, and storage and exposure requirements, including baking and rebaking.
 - 2. Plans of levels showing dimensioned location of edge of slab, deck, and openings.
 - a. Submit prior to shop and erection drawings.
 - 3. Shop and Erection Drawings:
 - a. Detailed shop and erection drawings for structural steel prior to start of fabrication and erection, showing:
 - b. Size and location of structural members and connection material.
 - c. Type, size and location of bolts and welds.
 - d. Identification of high-strength bolted joints as snug-tight, pretensioned or slip-critical, as required by Contract Documents.
 - e. Locations where Construction Documents require backing bars to be removed.
 - f. Locations where Construction Documents require supplemental fillet welds where backing is permitted to remain.
- E. Do not fabricate material prior to obtaining final review of submittals.

1.04 QUALITY ASSURANCE

- A. Welding Inspector Qualifications:
 - 1. Welding Inspectors:
 - a. Trained and thoroughly experienced in inspecting welding operations, and qualified as Certified Welding Inspectors (CWI) in accordance with AWS D1.1, AWS D1.3, AWS D1.8, and AWS QC1.

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- B. Bolting Inspector Qualifications:
 - 1. Demonstrate competency through administration of written examination and through hands-on demonstration by Inspector of methods to be used for bolt installation and inspection.
- C. Qualifications:
 - 1. Steel Fabricator Qualifications:
 - a. Have had not less than 5 years experience in fabrication of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel, and completed projects.
 - b. Be City of Los Angeles Approved Licensed Fabricator or AISC Certified..
 - 2. Steel Erector's Qualifications:
 - a. Have had not less than 5 years experience in erection of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel and completed projects.
 - 3. Welder Qualifications:
 - a. Welders, Welding Operators, and Tackers:
 - 1) Qualified in accordance with AWS D1.1 and D1.8.
 - 2) Have valid Welding Performance Qualification Record (WPQR) for each welding procedure to be performed.
 - b. Requalify Welders whose work fails to pass inspection before they perform further welding.
 - c. FCAWS and FCAW-G are considered separate processes for welding personnel qualification
 - d. Qualification Period:
 - 1) Requalify personnel who have not welded for period of three or more months.
 - 2) Requalify Welding personnel required to be tested using Supplemental Welding Personnel Testing by test within 12 months prior to beginning welding on Project.
 - e. Pay costs of certifying qualifications and requalification of welding personnel.
- D. Quality Assurance Submittals:
 - 1. Owner's Testing Agency will submit following items:
 - a. Quality Assurance Plan:
 - 1) Quality Assurance Plan containing Quality Assurance and Inspection items contained in this Section.
 - 2) Qualifications of Owner's Testing Agency management and personnel designated for Project.
 - 3) Owner's Testing Agency's Quality Control Plan for monitoring and control of Agency's operations.
 - b. Written Practice for Owner's Testing Agencies:
 - 1) Maintain Written Practice for selection and administration of inspection personnel, describing training, experience, and examination requirements for qualification and certification of inspection personnel, including those of subcontracting agencies.
 - 2) Include following descriptions in Written Practice:
 - a) Agency's procedures for determining acceptability of structure in accordance with applicable codes, standards, and specifications.

- b) Agency's inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.
- 3) Bolting Inspection Procedures:
 - a) Comply with AISC 348 and Quality Assurance Plan.
- 4) Welding Inspection Procedures:
 - a) Meet requirements of AWS D1.1 and D1.8, and Quality Assurance Plan.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.
- B. Store structural steel and handle in manner that prevents damage or distortion.
 - 1. Discharge materials carefully
 - a. Do not dump onto ground.
- C. Do not store materials on structure in manner that might cause distortion or damage to members of supporting structure.
- D. Store structural steel members, whether on or off site, above ground on platforms, skids, or other support; store other materials in weather-tight, dry place until use.
- E. Store materials to permit easy access for inspection and identification.
- F. Electrode Requirements:
 - 1. Package weld filler metals conforming to requirements of AWS D.1.1.
 - a. Only receive FCAW electrodes in undamaged moisture-resistant containers.
 - b. Protected electrodes against contamination and injury during shipment and storage.
 - c. When removed from protective packaging and installed on machines, take care to protect electrodes and coatings from deterioration or damage.
 - 2. Modification or lubrication of electrode after manufacture is not permitted.
 - a. Exception – Drying only permitted when recommended by manufacturer.
- G. Store fasteners in protected place.
 - 1. Except for ASTM F 1852 "twist-off" type assemblies, clean and relubricate bolts, nuts and washers that become dry or rusty before use.
 - 2. ASTM F 1852 fastener components may be relubricated following manufacturer's written instructions, and must be retested after relubrication and prior to use to verify suitability for installation.

1.06 PROJECT CONDITIONS

- A. Provide Owner's Testing Agency with free access to places on and off Project Site where materials are stored or fabricated, to places where equipment is stored or serviced, and to Project Site.

- B. Sequencing and Scheduling:
 - 1. Notify Architect and Owner's Testing Agency in sufficient time prior to shop or field fabrication and erection to permit testing and inspection without delaying Work.
 - 2. Ensure timely delivery of items to be embedded in Work of other sections; furnish setting drawings and directions for installation
 - 3. Provide templates for setting of anchor rods, one per location.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Structural Steel:
 - 1. Domestically fabricated in United States of America (USA) for welded pieces.
- B. Steel Shapes, Plates, Tube, Pipe, and Other Sections:
 - 1. As noted on Drawings.
 - 2. HSS Shapes:
 - a. Manufactured (rolled and seam welded) in USA.
 - 3. Alternatively, HSS shapes from outside USA when accepted:
 - a. Test seam welds by ultrasonic examination.
 - 4. Costs of tests and repairs, borne by Contractor.
- C. Standard Threaded Fasteners:
 - 1. Machine Bolts and Nuts: ASTM A307, Grade A.
 - 2. Plain Washers: ASTM F844.
 - 3. Beveled Washers: ANSI B18.23.1.
- D. High Strength Bolts:
 - 1. ASTM A325, snug-tight, unless otherwise noted.
 - 2. Bolted Joints in Seismic-Load-Resisting System:
 - a. Slip-Critical, with pretensioned high-strength bolts and Class A faying surface or better.
 - 3. Twist-off-Type Tension-Control Bolt Assemblies: ASTM F1852.
 - 4. Direct Tension Indicators: Load Indicator Washers: ASTM F959
 - 5. Nuts for High Strength Bolts: ASTM A563.
 - 6. Washers for High Strength Bolts: ASTM F436.
- E. Welding Materials:
 - 1. Comply with AWS D1.1 and D1.8 with nominal 70 ksi tensile strength.
 - 2. Supplemental Requirements for Seismic-Load-Resisting System:
 - a. Welds: Meet requirements of AWS D1.8, Section 6.
- F. Welded Stud Connectors:
 - 1. Headed Shear Studs:
 - a. AWS D1.1 "Type B" automatic end-welded headed studs made from ASTM A108, Grade 1015 or 1020.
 - 2. Threaded Studs:
 - a. Automatic end-welded threaded studs made from ASTM A108, Grades 1010 through 1020.
- G. Anchor Rods and Nuts:
 - 1. ASTM F1554; Grade as noted on Drawings.

2. Grade 55:
 - a. Weldable per supplement S1.
 - b. Minimum CVN toughness of 15 ft-lbs at 40 degrees F per supplement S4.
- H. Threaded Rods:
 1. As noted on Drawings.
- I. Shop Primer:
 1. Carbozinc 859 VOC Organic Zinc-Rich Epoxy Primer by Carboline Company, Hydro-Zinc 94-H20 by Tnemec Company; or approved equal.
 - a. VOC compliant with SCAQMD Rule 1113.
 2. Coordinate selection of primer with finish paint requirements in Section 09 9600.
 - a. Primer and finish coat materials for exposed steel are required to be complete system by one manufacturer
 3. Prime painting with specified shop primer is required of structural steel, exposed or concealed, except where indicated otherwise.
- J. Galvanizing:
 1. Provide zinc coating for those items indicated or specified to be galvanized, as follows:
 - a. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8 inch thick and heavier.
 - b. ASTM A 386 for galvanizing assembled steel products.
 - 1) Perform galvanizing after fabrication with Work assembled in as large sections as can be handled.
 - c. ASTM A 153 for galvanizing iron and steel hardware.
 2. Remove projections, barbs, and icicles after galvanizing.
 3. Do not galvanize AESS and other exposed structural steel and components specified to receive zinc-rich primer and high performance paint system.
- K. Galvanizing Repair Paint:
 1. Zinc-rich coatings meeting requirements of ASTM A780 or SSPC Paint-20, with dry film containing not less than 94 percent zinc dust by weight.
- L. Dry-Pack Cement Grout:
 1. Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C 404, Size No.2).
 2. Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.
- M. Nonshrink Nonmetallic Grout:
 1. Factory premixed, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
 2. Provide one of following or grout specifically recommended by manufacturer for types of applications indicated:
 - a. Masterflow 713 Plus; BASF Building Systems
 - b. Sealtight 588 Grout; W.R. Meadows
 - c. Five Star Grout; Five Star Products, Inc.
 - d. SikaGrout 212; Sika Corporation.

2.02 SOURCE QUALITY CONTROL

- A. Owner's Testing Agency will:
 - 1. Review ladle analysis and certificates of compliance.
 - a. Where certification is questionable, test material to verify compliance.
 - 2. Inspect shop fabrication.
 - 3. Provide management, personnel, equipment, and services required to perform quality control functions required below.
 - 4. Forward copies of product and procedure certificates, data sheets, and test and inspection reports to Owner, Architect, Structural Engineer, Contractor, and DSA.
 - 5. Review and approve Welding Procedure Specifications (WPSs).
- B. Welding Inspection:
 - 1. Welding Inspector:
 - a. Do not consider following list to be exclusive of additional inspection tasks that may be necessary to meet requirements of AWS D1.1 and D1.8, CBC, and Quality Assurance Plan.
 - b. Perform tasks indicated in following list:
 - 1) Review and understand applicable portions of specifications, Contract Documents and shop drawings for Project.
 - 2) Verify that applicable welder qualifications, welding operator qualifications, and tack welder qualifications are available, current, accurate, and in compliance with this Section.
 - 3) Verify welder identification and qualification.
 - a) Verify that required supplemental welder qualification testing, when required for joint, has been executed and that welder has passed.
 - 4) Verify that each welder has unique identification mark or die stamp to identify welds.
 - 5) Verify that applicable Welding Procedure Specifications (WPSs), with Procedure Qualification Records (PQRs) as needed, are available, current and accurate, and comply with AWS D1.1 and D1.8 and this Section.
 - 6) Verify that approved Welding Procedure Specification (WPS) has been provided and that each welder performing weld has reviewed WPS.
 - a) Make copy of appropriate WPS available for each joint, although need not be present at each joint location.
 - 7) Review mill test reports for main member and designated connection base material for compliance with Project requirements.
 - 8) Verify base material identification with Contract Documents.
 - 9) Verify electrode, flux and shielding gas certifications for compliance with Contract Documents.
 - 10) Verify welding consumables with approved WPSs.
 - 11) Verify that electrodes are used only in permitted positions and within welding parameters specified in WPS.
 - 12) Verify that electrodes and fluxes are properly stored, and that exposure limits for welding materials are satisfied.

- 13) At suitable intervals, observe joint preparation, assembly practice, preheat temperatures, interpass temperatures, welding techniques, welder performance, and post-weld controlled cooling and heat treatment to ensure that requirements of WPS and AWS D1.1 and D1.8 are satisfied.
- 14) At suitable intervals, verify current and voltage of welding equipment in application of WPS, when needed, by calibrated amp and voltmeter.
 - a) Measure current and voltage near arc with this equipment.
- 15) Inspect Work to ensure compliance with AWS D1.1 and D1.8 and specified weld acceptance criteria.
- 16) Mark welds, parts, and joints that have been inspected, and accepted, with distinguishing mark or die stamp, or maintain records indicating specific welds inspected and accepted by each inspector.
- 17) Document accepted and rejected items in written report.
 - a) Transmit report to designated recipients in timely manner.

2.03 FABRICATION

A. General Requirements:

1. Fabricate structural steel in accordance with AISC 360 (Chapter M and Section J2), AISC 303, and AWS D1.1 and D1.8 as applicable to Statically Loaded Structures, except as otherwise noted herein.
 - a. Assume thermally cut edges are subject to tension stresses.
 - b. Delete paragraphs M4.6 and M5.1 from Chapter M of AISC 360.
2. Fabricate and assemble work in shop to greatest extent possible.
3. Where possible, use procedures that do not require Architect's approval.
 - a. Such approval may not be given in some circumstances.
4. Coordinate as required for attachment of other work to structural steel.
5. Drill or punch holes for passage of reinforcing steel shapes, sections, plates, or bars as indicated on Structural Drawings.
 - a. Notify Architect of conditions not shown or noted.
6. Allowable Tolerances:
 - a. Comply with AISC 360, Chapter M, and AISC 303, Section 6.
 - b. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt more restrictive tolerances.
7. Holes and attachments to structural steel in areas designated as Protected Zone are not allowed except as explicitly shown or noted on Structural Drawings.

B. Connections:

1. Shop Connections:
 - a. Bolted or welded as noted.
2. Field Connections:
 - a. Locate splices only where noted or approved by Architect.
3. Assemble structural steel in shop to maximum extent possible, prior to shop priming or galvanizing.

C. Bolted Joints:

1. Punch or drill holes 1/16 inch larger than bolt size.
 - a. Drill material having thickness in excess of connector diameter plus 1/8 inch rather than punch.

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2. Ream unfair holes, but only up to next larger bolt size and install bolt corresponding to new hole size.
 - a. Where unfairness exceeds maximum, weld hole in base material solid and drill hole of proper size.
 3. Remove burrs that would prohibit solid seating of connected parts.
 4. Mark completely tightened bolts with identifying symbol.
 5. Provide hardened washers over slotted holes.
 6. Draw up tight, check threads with chisel or provide approved lock washers where bolts are not pretensioned.
 7. Assembly with Standard Threaded Fasteners:
 - a. Provide beveled washers under bolt heads or nuts resting surfaces exceeding five percent slope with respect to head or nut.
 8. Assembly of High-Strength Structural Bolted Joints:
 - a. Meet requirements of AISC 348.
 - b. Seismic-Load Resisting System Joints:
 - 1) Slip-critical (friction-type) as defined in AISC 348 with Class A or better faying surfaces.
 - c. Provide hardened washers under provided under the element turned in tightening procedure of high strength bolts.
 - d. Direct Tension Indicator Washers, Where Used:
 - 1) Provide under head of slip-critical high strength bolts.
- D. Welded Construction – Shop and Field:
1. Weld in accordance with AISC 360, AWS D1.1 and D1.8, and CBC Chapter 22.
 2. Perform welding in accordance with WPS for joints.
 3. Welds Permanently Exposed to View:
 - a. Remove burrs, flux, welding oxide air spots, and discolorations.
 - b. Make surfaces of such welds reasonably smooth and uniform.
 4. Make exterior welds watertight.
 5. Assign each welder working on Project identification symbol or mark.
 - a. Require each welder to mark or stamp this identification symbol at each weld completed.
 - b. When used, stamps, are to be low-stress type.
 6. Groove Welds:
 - a. Complete-joint-penetration welds, unless specifically designated otherwise.
 7. Make WPS available to welders and inspectors prior to and during welding process.
 - a. Prior to welding, verify joint fit-up by welder for conformance with WPS and AWS D1.1 and D1.8.
- E. Camber:
1. Provide camber as indicated on Contract Drawings in accordance with AISC 360 Chapter M2.1.
- F. Welded Connectors:
1. Install in accordance with AWS D1.1 and D1.8 and manufacturer's recommendations.
 2. No porosity or evidence of lack of fusion between end of stud and steel member is permitted.

G. Surface Finish

1. Flush Surfaces:
 - a. Finish welds in butt joints required to be flush, so as not to reduce thickness of thinner base metal or weld metal by more than 1/16 inch, or 5 percent of material thickness, whichever is less.
 - b. Remaining reinforcement not to exceed 1/32 inch in height.
 - 1) Remove reinforcement where weld forms part of faying or contact surface.
 - 2) Blend reinforcement smoothly into plate surfaces with transition areas free from undercut.
2. Finish Methods and Values:
 - a. Chipping and gouging may be used, provided these methods are followed by grinding.
 - b. Where surface finishing is required, finish surface Extra Smooth, unless otherwise noted or specified.
 - c. Measurement of surface finish values by visual appearance or tactile comparison is acceptable.

H. Repair of Gouges:

1. Gouges are not permitted in areas requiring AESS finish surface, or where specifically prohibited by AWS D1.1 and D1.8 or this Section.
2. Repair of Gouges:
 - a. Meet following requirements, unless otherwise noted:
 - b. Shallow Gouges:
 - 1) Remove gouges up to 3/16 inch deep by grinding per D1.1, or to radius of not less than 3/8 inch.
3. Deep Gouges:
 - a. Repair gouges deeper than 3/16 inch by welding.
 - b. Prior to welding, grind gouges to provide smooth contour with radius not less than 3/8 inch.
 - c. Preheat repair area to temperature between 400 degrees F and 550 degrees F, measured at point of welding approximately one minute after removal of heating source, or preheat in accordance with AWS D1.1 Annex XI for high restraint.
 - 1) Follow written repair WPS for application.
 - 2) Following completion of welding, grind area flush and smooth, with fairing of welded surface to adjoining surfaces where applicable, and inspect using magnetic particle testing (MT).
4. Transitional slope after gouge removal not to exceed 1:5.

I. Weld Acceptance Criteria:

1. In accordance with AWS D1.1 and D1.8.
2. Identify regions of welds that cannot be inspected and record, and notify Structural Engineer.

2.04 SHOP FINISHES

A. Galvanizing:

1. Provide hot dip galvanize coating in accordance with ASTM A 153 for exterior bolts, fasteners, and hardware when indicated.
2. Perform galvanizing after fabrication, including but not necessarily limited to, shearing, punching, bending, forming, assembling, and welding in largest units practicable.

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3. Remove projections, barbs, and icicles after galvanizing.
 4. Repair abraded galvanized surfaces not indicated to be painted as specified in "Execution"
 5. Do not galvanize items indicated or specified to receive organic zinc-rich epoxy shop primer.
 - a. This includes AECS and other steel components exposed in final Work.
- B. Shop Prime Painting:
1. Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar, or indicated to be galvanized.
 2. Paint embedded steel which is partially exposed on exposed portions and initial 2 inches of embedded areas only.
 - a. Do not paint surfaces which are to be welded
 - b. Do not paint surfaces or components where indicated to be galvanized.
 3. Preparation:
 - a. Clean surfaces of mill scale, grease, dirt and foreign matter by sandblasting or wire brushing with power tool.
 - 1) Prepare surfaces according to SSPC-SP 2 as minimum.
 - 2) Prepare surface specified to receive organic zinc-rich primer according to SSPC- SP6.
 4. Contact Surfaces:
 - a. Clean immediately prior to assembly and leave unpainted.
 - 1) Heavily coat machine finished surfaces with tallow or other similar removable viscous coating to prevent corrosion.
 5. Priming:
 - a. Apply one coat primer, minimum 3.0 mils dry film thickness.
 - b. Prime steel parts not in contact but inaccessible for priming after erection with two coats of primer, minimum total of 6.0 mils dry film thickness.
 - c. Thoroughly work primer into joints, angles, and open spaces.
 6. Touch-up of Shop Coat:
 - a. Clean abraded, burned, and otherwise damaged spots and exposed bolts in accordance with SSPC-SP 2 or SP 3 and apply one coat of specified primer.
 7. Rusting:
 - a. Remove and replace shop prime coat showing evidence of rusting over 25 percent of surface after erection.

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine units of Work to be placed and verify that anchor rods have been installed properly and have sufficient bolt and thread elevation.
- B. Do not begin erection before unsatisfactory conditions have been corrected.

3.02 ERECTION

- A. General Requirements:
 1. Erect structural steel in accordance with AISC 360 Chapter M, AISC 303, and AWS D1.1 – Structural Steel Welding Code as applicable to Statically Loaded Structures.

2. Requirements for bolted and welded joints specified in Part 2 of this Section also apply to field connections unless otherwise noted.
 3. Erection Tolerances:
 - a. Do not exceed erection tolerances specified in AISC 303, Section 7.
 - b. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt more restrictive tolerances.
 4. Where erection requires performing work of fabrication on Project Site, conform to applicable standards for fabrication.
- B. Field Cutting or Alteration:
1. Field cutting, alteration, or repair of structural steel members or of connections will not be permitted without prior review and approval by Structural Engineer.
 2. Repair structural elements with fabrication errors or that do not satisfy tolerance limits.
 - a. Submit drawings showing reasons for, and details of, proposed corrective Work.
- C. Set anchor rods in conformance with Section 7.5 of AISC 303.
- D. Temporary Shoring and Bracing:
1. Provide shoring and bracing as needed until permanent lateral-support is in place and complete.
 2. Contractor is responsible for identifying need for temporary shoring and bracing.
- E. Erection Procedures:
1. Control erection procedures and sequences to avoid problems caused by temperature differentials and weld shrinkage, and other sources of expansion and contraction.
- F. Field Assembly:
1. Clean bearing surfaces and surfaces to be in permanent contact before assembling members.
 2. Do not fasten splices of columns and other members with bearing joints designated on Drawings before abutting surfaces have been brought completely into contact.
 3. Bolted Construction:
 - a. Installation of high-strength bolts conforming to ASTM A325 for slip-critical or snug-tightened type joints, as applicable, in accordance with AISC 348.
 - 1) Provide washer under:
 - a) Head or nut of high strength bolts.
 - b) Element being turned during tightening.
 - 2) Tension bolts in welded connections after completion of welding.
 - b. At bolted joints designated as Slip-Critical or that require Pretension, use Twist-off-Type Tension-Control bolt assemblies or Direct Tension Indicators.
 - c. Do not use flame cutting to align bolt holes except as permitted by AISC 348 specifications.
 - 1) Ream holes that must be enlarged to admit bolts.
 - 2) Do not enlarge holes to diameter greater than 1 inch.
 - 3) When reaming beyond 1/32 inch, drill or ream to next larger hole size and use next larger size bolt.

4. Remove mill scale from column in area where beam flanges will be welded to column.
- G. Gas Cutting:
 1. Use of flame cutting torch is generally prohibited and will only be permitted after Architect's prior written approval and only where metal cut will not carry stress during cutting, and cut surfaces will not be visible.
 2. When thermal cutting is permitted, perform cutting with mechanically guided torch or torch controlled using guide bar.
- H. Field Touch-Up Painting:
 1. After erection, touch-up paint field connections and abrasions resulting from Work of this Section, with same paint used for shop prime painting.
- I. Remove and repair galvanized surface as required for field welding in accordance with ASTM-A780, A2; required thickness is 100 micro-inches.
 1. Touch up with specified zinc-rich coating.
 2. Extend repair material at least three inches beyond edges of damaged areas.

3.03 CLEANING

- A. After erection, thoroughly clean surfaces of foreign or deleterious matter such as dirt, mud, oil, or grease that would impair bonding of concrete, or other finishes as applicable.

3.04 FIELD QUALITY CONTROL

- A. Owner's Testing Agency Requirements:
 - a. Verify proper anchor rod group location, elevation, and orientation prior to placement of concrete foundations, and subsequent to placement of concrete foundations prior to arrival of structural steel.
2. Perform field welding inspection and testing in accordance with requirements in Part 2 of this Section for shop fabrication, unless otherwise noted.
3. Inspect and test high strength bolted joints in accordance with AISC 348.
4. Sample and test bolt assemblies that include direct tension indicators, on daily basis to verify proper indication of deformation with required bolt tension for each size and lot.
5. Inspect erected structural steel as required to establish conformity of Work with reviewed shop drawings and Contract Drawings.
6. Perform testing and inspection of welded stud connectors in accordance with requirements of AWS D1.1 and D1.8.
 - a. No evidence of tearing or cracking of weld section after performance of bend test.
7. Forward copies of test and inspection reports to Owner, Architect, Structural Engineer, Contractor, and DSA.

END OF SECTION 05 1200

SECTION 05 3000

METAL DECKING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Metal Roof Decking as indicated.
 - 2. Accessory items include but are not necessarily limited to:
 - a. Metal Closure strips.
 - b. Flexible Closure Strips
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code Edition
 - 2. Section 01 4500: Quality Control.
 - 3. Section 05 1200: Structural Steel Framing
 - 4. Section 06 1053: Miscellaneous Carpentry; wood blocking and nailers.
 - 5. Section 07 4113: Metal Roof Panels
 - 6. Section 07 6200: Sheet Metal Flashing and Trim.
 - 7. Section 07 9200: Joint Sealants
 - 8. Section 09 9600: High Performance Coatings; painting of exposed metal decking.
- C. Related Requirements:
 - 1. Refer to respective Sections of Division 26 electrical equipment scheduled to installed on Roof for coordination with roof openings and penetrations.

1.02 REFERENCES

- A. Comply with requirements of California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
- B. ASTM International (ASTM):
 - 1. ASTM A 36 – Standard Specification for Carbon Structural Steel
 - 2. ASTM A 108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
 - 3. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 4. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - 5. ASTM D 746 – Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
 - 6. ASTM D 1056 – Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber
- C. American Welding Society (AWS):
 - 1. AWS D1.1 – Structural Welding Code-Steel
 - 2. AWS D1.3 – Structural Welding Code-Sheet Steel

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- D. American Iron and Steel Institute (AISI):
 - 1. AISI Specification for Design of Cold-Formed Steel Structural Members.
- E. Steel Deck Institute (SDI):
 - 1. SDI Design Manual for Floor Decks and Roof Decks.
- F. International Association of Plumbing and Mechanical Officials (IAMPO):
 - 1. Uniform Evaluation Reports (UES):
 - a. IAMPO ER-0161
 - b. IAMPO ER-2018

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications and installation instructions for each product specified.
 - a. Include manufacturer's certification as may be required to show compliance with these specifications.
 - 2. Furnish IAMPO UES Reports for each metal deck type.
- B. Shop Drawings:
 - 1. Detailed drawings showing layout and types of deck panels, anchorage details and every condition requiring closure panels, supplementary framing, special jointing or other accessories.
 - a. Indicate manufacturer's name, metal gage, and deck section properties.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. ASC Steel Deck
- B. Verco Decking, Inc.
- C. Members of Steel Deck Institute (SDI), or approved equal.

2.02 MATERIALS

- A. Structural Steel:
 - 1. Domestically manufactured and fabricated in United States of America (USA).
- B. Metal Decking:
 - 1. Roll-formed sheets conforming to ASTM A 653, with G90 zinc coating.
 - 2. Section properties conforming to applicable provisions of latest edition of AISI – Specification for the Design of Cold-Formed Steel Structural Members.
- C. Miscellaneous Steel Shapes:
 - 1. Conforming to ASTM A 36 for steel shapes not covered in Section 05 1200.
- D. Flexible Closure Strips:
 - 1. Vulcanized, closed-cell, expanded chloroprene elastomer, complying with ASTM D 1056, Grade SCE No. 41.
 - 2. Brittleness Temperature: Minus 40 degrees F, ASTM D 746.
 - 3. Flammability Resistance: Self-extinguishing.

- E. Sheet Metal Accessories:
 - 1. Sheet steel, minimum yield strength of 33,000 psi, not less than 0.0359 inch thickness, of same material and finish as deck, profile indicated or required for application.
 - 2. Furnish with ASTM A 653, G90 zinc coating.
- F. Metal Closure Strips:
 - 1. Fabricate metal closure strips of galvanized sheet steel of same quality as deck units, but not less than nominal 0.0359 inch (20 gage) thick before coating.
 - 2. Form to configuration required to provide tight-fitting closures at open ends and sides of decking.
- G. Joint Sealing Material:
 - 1. Non-skinning, gun-grade, bulk compound as recommended by deck manufacturer.
 - 2. Comply with requirements of Section 07 9200.

2.03 FABRICATION

- A. Form deck units of sections designed to support required live load between supporting members
 - 1. Provide decking in lengths to span over three or more supports with flush, with interlocking side laps, 2-1/2 inches minimum end bearing, and 1-1/2 inches minimum side bearing, unless otherwise indicated.
- B. Roof Deck Units:
 - 1. Provide G90 galvanized non-vented deck configurations complying with SDI – Roof and Floor Deck Specifications, of metal thickness, depth and width as shown.
- C. Metal Closure Strips:
 - 1. Fabricate metal closure strips of galvanized sheet steel of same quality as deck units, but not less than nominal 0.0359 inch (20 gage) thick before coating.
 - 2. Form to configuration required to provide tight-fitting closures at open ends and sides of decking.
- D. Welding:
 - 1. Provide materials and methods in accordance with recommendations of steel decking manufacturer.
 - 2. Hold decking tight to supporting elements with screws or other means for proper welding or crimping of decking edges.
 - 3. Conform to AWS D1.3, and to patterns and weld types indicated, with welds free from sharp edges and protrusions.
 - 4. Field coat welds and abraded surfaces at completion with anodic type galvanizing repair paint.

2.04 PERFORMANCE REQUIREMENTS:

- A. Calculate properties of deck sections on basis of effective design width as limited by provisions of AISI specifications.
 - 1. Provide deck section properties not less than those specified, including section modulus and moment of inertia per foot of width.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install metal deck units and accessories in accordance with manufacturer's recommendations, final shop drawings, and as specified.
- B. Do not start placement of deck units before supporting members are installed.
 - 1. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened.
 - 2. Lap ends not less than what is specified in this Section.
 - 3. Do not stretch or contract side-lap interlocks.
- C. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
- D. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- E. Do not use deck units for storage or working platforms until permanently secured in position.
- F. Fastening Deck Units:
 - 1. Permanently fasten deck units to steel supporting members as noted on Structural Drawings.
 - 2. Fasten side laps between supports as indicated on Drawings.
- G. Cutting and Fitting:
 - 1. Cut and fit deck units and accessories around other work projecting through or adjacent to decking.
 - 2. Provide neat, square and trim cuts.
- H. Reinforcement at Openings:
 - 1. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.
- I. Roof Insulation Support:
 - 1. Provide metal closure strips for support of roof insulation where rib openings in top surface of roof decking occur adjacent to edges and openings.
 - 2. Weld closure strips into position.
- J. Field Touch-Up:
 - 1. Galvanized Surfaces:
 - a. After decking installation, wire brush, clean, and touch-up scarred areas, welds, and rust spots on top and bottom surfaces of decking units.
 - b. Clean field welds and abraded areas and apply galvanizing repair paint according to ASTM A 780.
 - 2. Refer to Section 09 9600 for preparation, priming, and finish field painting of underside of exposed metal decking.

3.02 CLEANING

- A. Remove and legally dispose of rubbish, debris, and waste materials off Project Site, complying with requirements of Section 01 7419.

3.03 FIELD QUALITY CONTROL

- A. Install steel decking under continuous inspection according to CBC Chapter 22A.

3.04 PROTECTION

- A. Protect Work until Substantial Completion.

END OF SECTION 05 3000

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SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous metal fabrications as shown.
 - a. Includes items fabricated from iron and steel shapes, plates, and bars which are not part of other metal systems specified elsewhere.
 - 2. Work includes, but is not necessarily limited to:
 - a. Anchor bolts, not specified elsewhere.
 - b. Miscellaneous steel framing and supports
 - c. Miscellaneous steel trim
 - d. Steel guard posts (Bollards).
 - e. Steel pipe handrails.
 - 3. Furnishing inserts and anchoring devices which must be set in concrete for installation of miscellaneous metal work.
 - a. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices.
 - b. Coordinate delivery with other Work to avoid delay.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 09 9100: Painting; shop priming and field painting of exposed metal work not indicated to receive shop-applied or high performance coatings.
 - 3. Section 09 9600: High Performance Coatings; shop priming and field painting of exposed steel components where indicated.

1.02 REFERENCES

- A. California Code of Regulations, Title 24, California Building Code (CBC), Part 2, Volumes 1 and 2, current edition.
 - 1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.
- B. ASTM International (ASTM):
 - 1. ASTM A36 – Standard Specification for Carbon Structural Steel
 - 2. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 4. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
 - 5. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - 6. ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

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7. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 8. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 9. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 10. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
1. ASCE/SEI 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- D. American Welding Society (AWS):
1. AWS D1.1 – Structural Welding Code – Steel.
 2. AWS D1.3 – Structural Welding Code – Sheet Steel.
 3. AWS QC1 – Standard for AWS Certification of Welding Inspectors.
- E. American Institute of Steel Construction (AISC):
1. AISC 360 – Specification for Structural Steel Buildings.
- F. American Iron and Steel Institute (AISI):
1. AISI S100 – North American Specification for the Design of Cold-Formed Steel Structural Members.
- G. American National Standards Institute (ANSI):
1. ANSI ASC A14.3 - American National Standards For Ladders - Fixed - Safety Requirements
- H. Aluminum Association (AA):
1. Aluminum Design Manual, current edition
 2. CA-92 – Care of Aluminum
 3. DAF-45 – Designation System for Aluminum Finishes
- I. National Association of Architectural Metal Manufacturers (NAAMM):
1. AMP 500 – Metal Finishes Manual
- J. American Galvanizers Association, Inc. (AGA):
1. AGA - Inspection of Hot-Dip Galvanized Steel Products
- K. The Society for Protective Coatings (SSPC):
1. SSPC-SP 1 – Solvent Cleaning.
 2. SSPC-SP 2 – Hand Tool Cleaning.
 3. SSPC-SP 3 – Power Tool Cleaning.
 4. SSPC-SP 6 – Commercial Blast Cleaning.

1.03 SUBMITTALS

- A. Product Data:
1. Manufacturer's specifications, anchor details, and installation instructions for products to be used in fabrication of miscellaneous metal, including paint products.
 2. Product Data for Specified Shop Primer System:

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- a. Material List:
 - 1) Provide inclusive list of required coating materials Identify material by manufacturer's catalog number and general classification.
 - b. Manufacturer's Information:
 - 1) Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying coating material proposed for use.
- B. Shop Drawings:
- 1. For fabrication and erection of miscellaneous metal assemblies.
 - a. Include plans and elevations at not less than 1/2 inch to 1 foot scale.
 - b. Provide large scale construction details of various parts, including, but not necessarily limited to:
 - 1) Methods of joining.
 - 2) Thickness of metals.
 - 3) Profiles of surfaces.
 - 4) Reinforcing, anchorage, and accessory items.
 - c. Include details of sections and connections at not less than 3 inch to 1 foot scale.
 - 2. Include information regarding concealed and exposed joints, welds, and fastenings.
 - 3. Provide templates for anchor or bolt installation by others.
- C. Samples:
- 1. As requested by Architect.
- D. Electrode Requirements:
- 1. Package weld filler metals conforming to requirements of AWS D.1.1.
 - a. FCAW Electrodes: Received in undamaged moisture-resistant containers.
 - b. Protect electrodes against contamination and injury during shipment and storage.
 - c. When removed from protective packaging and installed on machines, take care to protect electrodes and coatings from deterioration or damage.
- E. Welding Procedures:
- 1. Procedures are to:
 - a. Assign responsibility to person or position.
 - b. Contain enough detail to be useful to workforce without reference to governing specifications.
 - c. Be dated and indicate person or position that has authority to maintain procedure.
 - 2. Welding Procedure Specifications (WPS):
 - a. Conform to requirements of AWS D1.1.
 - b. Submit Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR) as required by AWS D1.1, to be used on Project to Owner's Testing Agency.
 - 1) Owner's Testing Agency will review and approve WPS.
 - 2) Use forms provided in Annex E of AWS D1.1 or equivalent.
 - 3. Procedures need not act as work instructions.
 - 4. Weld Sequence Procedures:

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- a. Submit written procedures indicating field welding sequences for each type of connection with multiple field-welded joints, and sequence of such connections to be field-welded at each level.
5. Weld Shrinkage and Distortion Control Plan:
 - a. Where shrinkage is likely to cause distortion or other problems, submit mitigation plan.
 - b. Contractor is responsible for determining conditions requiring Weld Shrinkage and Distortion Control Plan.

1.04 QUALITY ASSURANCE

- A. Design Criteria:
 1. Design Work to support normally imposed loads and conform to AISC, AISI, and ASCE/SEI 7-16 requirements.
- B. Standards:
 1. Conform to applicable provisions and performance referenced standards where indicated.
- C. Field Measurements:
 1. Take field measurements prior to preparation of shop drawings and fabrication, where possible.
 2. Do not delay job progress; allow for trimming and fitting wherever taking field measurements before fabrication might delay Work.
- D. Qualifications:
 1. Fabricator Qualifications:
 - a. Successfully engaged for minimum of 5 years in manufacture of metal fabrications work, similar to that specified and indicated for this Project.
 - b. Fabricator qualifications are subject to Owner and Project Inspector's review and approval before subcontract is awarded.
 2. Qualifications for Welding Work:
 - a. Qualify welding procedures and welding operators in compliance with AWS Qualification requirements of AWS D1.1.
 - b. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, when pertinent, has undergone recertification..
 - c. When recertification of welders is required, retesting will be Contractor's responsibility.
 3. Welding Inspector Qualifications:
 - a. Welding Inspectors:
 - 1) Trained and thoroughly experienced in inspecting welding operations.
 - 2) Qualified as Certified Welding Inspectors (CWI) in accordance with AWS D1.1, AWS D1.3, and and AWS QC1.
 4. Welder Qualifications:
 - a. Qualify welders, welding operators, and tackers in accordance with AWS D1.1.
- E. Shop Assembly:
 1. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly.

2. Disassemble units only as necessary for shipping and handling limitations.
3. Clearly mark units for reassembly and coordinated installation.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.
- B. Discharge materials carefully and store on clean concrete surface or raised platform in safe, dry area.

1.06 PROJECT CONDITIONS

- A. Scheduling and Sequencing:
 1. Ensure timely fabrication of items to be embedded or enclosed by other Work.
 2. Furnish information and assistance required for locating embedded items and be responsible for proper locations.

PART 2 PRODUCTS

2.01 MATERIALS AND COMPONENTS – GENERAL

- A. Metal Surfaces – General:
 1. For fabrication of miscellaneous metal work which will be exposed to view, only use materials which are smooth and free of surface blemishes
 2. Do not use materials having exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, rolled trade names, roughness, oil canning, stains, discoloration or other imperfections.
- B. Steel Plates, Shapes and Bars:
 1. Conforming to ASTM A 36.
- C. Steel Sheets:
 1. Conforming to ASTM A 1011, Grade C.
- D. Steel Pipe:
 1. Conforming to ASTM A 53; Type S; Grade B; black finish unless galvanizing is required; standard weight (Schedule 40), unless otherwise shown or specified.
- E. Structural Steel Sheet:
 1. Hot-rolled, conforming to ASTM A 570, or cold-rolled conforming to ASTM A 611, Class 1.
 2. Grade required for design loading.
- F. Steel Plates:
 1. For cold forming or bending:
 2. Conforming to ASTM A 283, Grade C.
- G. Aluminum Members:
 1. Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish:
 2. 6061-T6 or 6063-T5 aluminum alloy, conforming to ASTM B 221 for extrusions and ASTM B 209 for sheet/plate.

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- H. Welding Electrodes and Filler Metal:
 - 1. Carbon Steel: Use electrodes recommended by AWS.
- I. Fasteners:
 - 1. Use fasteners made of same basic metal as fastened metal, unless otherwise indicated.
 - a. Do not use metals which are corrosive or incompatible with materials joined.
 - b. Do not use exposed fasteners except where unavoidable.
 - 1) Match finish of metal surrounding fastener.
 - 2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
 - 3. Select fasteners for type, grade and class required.
 - 4. Steel Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A; with hex nuts.
 - 5. Lag Bolts: Square head type, ASME B 18.2.1
 - 6. Machine Screws: Cadmium plated steel, ASME B 18.6.3
 - 7. Wood Screws: Flat head carbon steel, ASME B 18.6.1
 - 8. Plain Washers: Round, carbon steel, ASME B 18.21.1
 - 9. Lock Washers: Helical spring type carbon steel, ASME B 18.21.1
 - 10. Expansion Bolts:
 - a. Concrete Anchorage: Hilti Kwik Bolt TZ; ICC ESR-1917
 - b. Masonry Anchorage: Hilti Kwik Bolt 3; ICC ESR-1385
- J. Anchors and Inserts:
 - 1. Furnish inserts for setting in concrete and provide other anchoring devices as required for installation of fabricated metal items.
- K. Nonshrink Nonmetallic Grout:
 - 1. Factory premixed, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
 - 2. Provide one of following or grout specifically recommended by manufacturer for types of applications indicated:
 - a. Masterflow 713 Plus; BASF Building Systems
 - b. Sealtight 588 Grout; W.R. Meadows
 - c. Five Star Grout; Five Star Products, Inc.
 - d. SikaGrout 212; Sika Corporation.
- L. Shop Primer for Ferrous Metal:
 - 1. Carbozinc 859 VOC Organic Zinc-Rich Epoxy Primer by Carboline Company, Hydro-Zinc 94-H20 by Tnemec Company, or approved equal; VOC compliant.
 - 2. Coordinate selection of primer with finish paint requirements in Section 09 9600.
 - a. Primer and finish coat materials for exposed steel are required to be complete system by one manufacturer
 - 3. Prime painting with specified shop primer is required of structural steel, exposed or concealed, except where indicated otherwise.
- M. Galvanizing:
 - 1. Provide zinc coating for those items shown or specified to be galvanized, as follows:
 - a. Conform to ASTM A 123:

- 1) For galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8 inch thick and heavier.
 - 2) For galvanizing assembled steel products.
 - b. Conform to ASTM A 153:
 - 1) For galvanizing iron and steel hardware.
 2. Perform galvanizing after fabrication with Work assembled in as large sections as can be handled.
 3. Remove projections, barbs, and icicles after galvanizing.
 4. Galvanizing Repair Paint:
 - a. Organic zinc rich paint complying with SSPC-Paint 20, with dry film containing not less than 94 percent zinc dust by weight.
 5. Do not galvanize exposed steel and components indicated or specified to receive zinc-rich primer and high performance paint system.
- N. Isolation Between Dissimilar Materials:
1. Provide single-component, inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
 - a. VOC compliant.
 2. Elasto-Deck BT as manufactured by Pacific Polymers, div. ITW Polymers Sealants North America, or equivalent product acceptable to Architect.
- O. Joint Sealant:
1. Comply with requirements of Section 07 9200 and following.
 - a. Nonsag, nonstaining, silicone sealant complying with ASTM C 920.
 - b. Of type and grade required to seal joints in formed metal
 - c. As recommended in writing by formed metal manufacturer or fabricator.

2.02 FABRICATION – GENERAL

- A. Fabricate items to comply with requirements indicated, including those for quality, thickness and finish of material as well as those indicating dimensions and details.
1. Use heavier metal gages, stiffeners or metal backing as required to produce surface flatness, free of "oil-canning", and to impart sufficient strength for use indicated.
 2. When not otherwise indicated, provide following minimum thickness of metal and comply with SMACNA recommendations for fabrication and installation details:
 - a. Sheet Steel: 16 gage.
 - b. Galvanized Sheet Steel: 16 gage.
 3. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support.
 4. Use type of materials shown or specified for various components of Work.
- B. Use hot-rolled steel bars for work fabricated from bar stock, unless shown or specified to be fabricated from cold-finished or cold-rolled stock.
- C. Supply as part of this Section, miscellaneous small parts of material thinner than 10 gage, or items specifically called out, when such supply is normal and accepted part of Work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

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1. Ease exposed edges to radius of approximately 1/32 inch, unless otherwise shown.
 2. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.
- E. Form sheet metal items in maximum lengths and keep joints to minimum.
1. Do not exposed cut edges of sheet metal except as indicated.
 2. Fold back exposed ends of unsupported sheet metal to form 1/2 inch wide hem on concealed side, or ease exposed edges with backing to radius of approximately 1/32 inch.
 3. Form items with flat, flush surfaces, true to line and level, and without cracking and grain separation at bends.
- F. Continuously weld joints and seams except where other methods of joining are indicated
1. Grind welds smooth and flush on exposed surfaces.
 2. Comply with AWS recommendations.
 3. Use filler metals and welding procedures which will blend with and match color of sheet metal being joined and will avoid discoloration at welds.
- G. Provide type of anchorage shown.
1. Coordinate with supporting structure.
 2. Fabricate and space anchoring devices as shown and as required to provide adequate support for intended use.
- H. Cut, reinforce, drill and tap miscellaneous metal work as required to receive finish hardware and similar items.
- I. Fabricate joints which will be exposed to weather in manner to exclude water or provide weep holes where water may accumulate.

2.03 MISCELLANEOUS METAL FABRICATIONS

- A. Manufacture or fabricate items to sizes, shapes and dimensions required.
1. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.
- B. Miscellaneous Framing and Supports:
1. Provide miscellaneous steel framing and supports which are not part of structural steel framework, as required to complete Work.
 2. Fabricate miscellaneous units to sizes, shapes and profiles shown or, where not shown, of required dimensions to receive adjacent other work to be retained by framing.
 3. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection.
 4. Cut, drill and tap units to receive hardware and similar items.
 5. Equip units with integrally welded anchor straps for casting into poured concrete or building into masonry wherever required.
 6. Except as otherwise shown, space anchors 24 inches on center and provide minimum anchor units of 1-1/4 by 1/4 by 8 inch steel straps.
- C. Miscellaneous Steel Trim:
1. Provide shapes and sizes as required for profiles shown.

2. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges.
3. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation of other work.
4. Except as otherwise shown, space anchors 24 inches on center and provide minimum anchor units of 1-1/4 by 1/4 by 8 inch steel straps.
 - a. Galvanize miscellaneous steel trim where indicated.

2.04 STEEL PIPE HANDRAIL FABRICATION

- A. Fabricate pipe handrails to dimensions and details shown, with smooth bends and welded joints ground smooth and flush.
 1. Comply with requirements of CBC Section 11B-505 and as indicated for design, finish, member sizes, including wall thickness of pipe, post spacing, and anchorage, but not less than that required to support structural loads.
 2. Make handrail gripping surfaces continuous along their length.
 - a. Do not allow handrails to be obstructed along their tops or sides.
 - b. Do not permit bottom of handrail gripping surface to be obstructed for more than 20 percent of its length.
 3. Railings:
 - a. Use nominal 1-1/4 inch N.P.S. (1.660 inch O.D.) Schedule 40 galvanized steel pipe for railings and posts.
 4. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
 - a. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to which end is joined, and weld all around.
 - b. Form changes in direction of handrails and rails by welding in prefabricated flush elbow fittings.
 - c. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- B. Brackets, Flanges, Fittings, and Anchors:
 1. Provide flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of handrails and railing systems to other work.
 2. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete work.
- C. Fittings for Steel Handrails and Railing Systems:
 1. Provide ungalvanized ferrous metal fittings, brackets, and fasteners for railings specified or indicated to have painted finish.
 2. Secure railing in fittings to prevent rotation of railings. .
 3. Galvanize anchors and sleeves embedded in concrete construction.

2.05 FINISHES

- A. Comply with NAAMM Metal Finishes Manual for recommendations relative to application and designations of finishes, as applicable.
 1. Protect mechanical finishes on exposed surfaces by application of strippable, temporary protective covering prior to shipment.

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2. Variations in appearance of abutting or adjacent pieces are not acceptable when they are within 1/2 of range of approved samples.
 - a. Noticeable variations in same piece are not acceptable.
 - b. Variations in appearance of other components are acceptable when they are within range of approved samples and are assembled or installed to minimize contrast.
 3. Apply heavy coat of specified isolation material to metal surfaces in contact with concrete or dissimilar materials.
 - a. Do not apply on exposed surfaces.
- B. Preparations of Surfaces:
1. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from ferrous metal prior to galvanizing.
 2. Where hand cleaning methods are not adequate, clean in accordance with SSPC SP 1, SSPC SP 2, SSPC SP 3, or SSPC SP 6, as required.
 3. Completely eliminate burrs, rough spots and pitting from normally exposed ferrous metal items.
- C. Shop Painting:
1. Apply specified shop primer to uncoated surfaces of miscellaneous metal work, except members or portions of members to be embedded in concrete surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified.
 2. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at rate to provide uniform dry film thickness of 2.0 mils for each coat.
 - a. Use painting methods which will result in full coverage of joints, corners, edges and exposed surfaces.
 3. Apply one shop coat to fabricated metal items, except apply 2 coats of paint to surfaces inaccessible after assembly or erection.
 4. Where shop primer is removed or damaged by assembly procedures, touch up abraded areas with specified primer.
- D. Galvanized Finish:
1. Where specified, galvanize items after fabrication.
 2. Conform to requirements for galvanizing as specified in "Materials and Components" Article.
 3. Where galvanizing is removed by assembly procedures, touch up abraded areas with zinc-rich paint.
 4. Do not galvanize items indicated or specified to receive organic zinc-rich epoxy shop primer.

PART 3 EXECUTION

3.01 PREPARATION

- A. Examine areas to receive Work and verify that setting conditions and dimensions are correct to receive items.
1. Do not start installation until unsatisfactory conditions have been corrected.
- B. Field Measurements:
1. Perform sheet metal work in cooperation with other trades.

2. Where possible, verify size, location and placement of miscellaneous sheet metal work prior to fabrication.
 3. Coordinate field measurements and shop drawings with fabrication and shop assembly.
- C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete construction.
1. Coordinate delivery of such items to Project Site.

3.02 INSTALLATION

- A. Cutting and Fitting:
1. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications.
 2. Fit exposed connections accurately together to form tight hairline joints.
 3. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
 4. Grind joints smooth and touch-up shop paint coat.
 5. Do not weld, cut or abrade surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- B. Placement:
1. Set Work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
 2. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
 3. Galvanize exposed fasteners to secure to in-place construction.
 4. Fasten work tightly to prevent rattle or vibration.
 5. Do not tighten fasteners through finish alone without spacer washers.
 6. Use nonshrink grout mixed in accordance with manufacturer's direction for setting frames, plates, sills, bolts and similar items.
 7. Locate and place sheet metal items plumb, level and in alignment with adjacent work.
 8. Tolerances:
 - a. Offset from true horizontal, vertical and design location:
 - 1) Not to exceed 1/16 inch in 10 feet of length for any component, non-cumulative.
 - b. Maximum offset from true alignment between abutting components:
 - 1) Not to exceed 1/32 inch.
- C. Use concealed anchorages where possible.
1. Provide brass or lead washers fitted to screws where required to protect sheet metal surfaces.
 2. Provide concealed gaskets, flashing, sealants and fillers and install as Work progresses to make installations weathertight or sealed.
- D. Form tight joints with exposed connections accurately fitted together.
1. Provide reveals and openings for sealants and joint fillers, as indicated.

- E. Protect non-ferrous metal surfaces from corrosion or galvanic action by application of heavy coating of specified isolation coating material on concealed contact surfaces of dissimilar materials, before assembly and installation, where there is possibility of corrosive or electrolytic action.
- F. Field Welding:
 - 1. Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

3.01 FIELD PAINTING

- A. Touch-up Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting.
 - 2. Apply by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Repair of Galvanized Surfaces:
 - 1. Repair areas damaged by welding, cutting or during handling, transport or erection in accordance with ASTM A 780 by application of multiple coats of galvanizing repair paint, to dry film thickness of 8 mils.
- C. Repair of Finished Surfaces:
 - 1. Repair finishes damaged by cutting, welding, soldering and grinding operations required for shop fitting and jointing.
 - 2. Restore finishes so that there is no evidence of corrective work.
 - 3. Return items which cannot be refinished in field to shop, make required alterations, and refinish entire unit or provide new units, at fabricator's option.

3.02 CLEANING

- A. Remove protective devices only when items will be safe from other construction operations or removal is required to permit related Work.

3.03 PROTECTION

- A. Protect metal work from damage to surface, profile, and shape.

END OF SECTION 05 5000

SECTION 06 1053

MISCELLANEOUS CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Carpentry work not specified elsewhere and generally intended for support of other work.
 - 2. Miscellaneous blocking, grounds, and nailers.
 - 3. Electrical/Telephone Backing Panels
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 07 4113: Metal Roof Panels
 - 3. Section 07 6200: Sheet Metal Flashing and Trim
 - 4. Section 10 5613: Metal Storage Shelving
- C. Related Requirements:
 - 1. Refer to Division 26 sections for additional requirements for electrical/telephone backing panels.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
- B. American Plywood Association (APA):
 - 1. Guide to Plywood Grades
 - 2. Product Standard, PS-1 – Construction and Industrial Plywood.
- C. ASTM International (ASTM):
 - 1. ASTM F 1667 – Standard Specification for Driven Fasteners, Nails, Spikes, and Staples.
- D. UL, LLC (UL):
 - 1. Fire Hazard Classification – FR-S
- E. West Coast Lumber Inspection Bureau (WCLIB):
 - 1. Standard Grading Rules No. 17, current edition.
- F. Western Wood Products Association (WWPA):
 - 1. Standard Grading Rules for Western Lumber.
- G. American Wood Preservers Association Standards (AWPA)

1.03 SUBMITTALS

- A. Wood Treatment Data:
 - 1. General:
 - a. Obtain from chemical treatment manufacturer.

- b. Include chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated material:
2. Preservative Treatment – General:
 - a. Include certification by treatment plant stating type of solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
3. Waterborne Preservative Treatment:
 - a. Include certification that moisture content of treated wood was reduced to levels specified prior to shipment to Project Site.
4. Fire-Retardant Treatment:
 - a. Include certification by treating plant that treated wood complies with specified requirements.
5. Include warranty of chemical treatment manufacturer for each type of treatment.

1.04 QUALITY ASSURANCE

- A. Wood Product Quality Standards:
 1. Lumber Standards:
 - a. Comply with West Coast Lumber Inspection Bureau (WCLIB).
 2. Plywood Standard:
 - a. Comply with Voluntary Product Standard PS 1.
 3. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.
- B. Single-Source Responsibility for Fire Retardant Treated Wood:
 1. Obtain each type of fire-retardant-treated wood product from one source and by single producer.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage:
 1. Keep materials under cover and dry.
 2. Protect against exposure to weather and contact with damp or wet surfaces.
 3. Stack material above ground level on uniformly spaced supports to prevent deformation.
 4. For material pressure treated with waterborne chemicals, place spacers between each bundle for air circulation.

PART 2 PRODUCTS

2.01 LUMBER – GENERAL

- A. Standards:
 1. Furnish lumber manufactured to comply with PS 20 – American Softwood Lumber Standard, with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Grade Stamps:
 1. Furnish lumber with each piece factory marked with grade stamp of inspection agency that indicates grading agency, grade, species, moisture content at time of surfacing, and mill.

- C. Sizes:
 - 1. Provide nominal sizes indicated, complying with PS 20, except where actual sizes are specifically noted as being required.
- D. Surfacing:
 - 1. Dressed lumber, S4S, unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED CONDITIONS

- A. Species: Wood species listed by PS 20.
- B. Moisture Content: S-DRY, KD 19 or MC 19 (19 percent maximum moisture content).
- C. Grade: No.2, or standard grade.
- D. Grade: No.3, or utility grade.

2.03 PLYWOOD

- A. Identify each panel with appropriate trademark of APA.
 - 1. Meet requirements of latest edition of Voluntary Product Standard PS 1 and Voluntary Product Standard PS 2
- B. Panel Size, Thickness, and Grade: At least equal to that indicated.
- C. Electrical/Telephone Backing Panels:
 - 1. Fire-retardant plywood with exterior glue containing no urea formaldehyde.
 - 2. Grade: C-D Plugged, Exposure 1,
 - 3. Thickness: As indicated, but not less than 1/2 inch nominal.
 - 4. Coordinate with Division 26 Sections.

2.04 WOOD SHELVING:

- A. Industrial Grade Medium Density Fiberboard (MDF) complying with ANSI A208, Grade 130.
 - 1. Manufactured with synthetic resin binder system.
 - a. Certified as Class 1 Flame Retardant panel in accordance with ASTM E 84.
 - 2. Thickness: Minimum
 - a. Minimum 3/4 inch for metal storage shelving units.
 - 3. Product and Manufacturer:
 - a. Medite FR by Roseburg Forest Products Company, Springfield, OR, or approved equal.

2.05 FASTENERS

- A. Nails, Wire, Brads, and Staples:
 - 1. Conforming to ASTM F 1667.
- B. Bolts:
 - 1. Conforming to ASTM A 307, Grade A.
 - 2. With hex nuts and flat washers conforming to ASTM A 563.

2.06 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

- A. Obtain preservative-treated lumber complying with AWWA Standard C2.
 - 1. Mark each treated item with AWPB or SPIB Quality Mark Requirements.
 - 2. Coat surfaces cut after treatment to comply with AWWA M4.
- B. Above-Ground Wood Treatment:
 - 1. Pressure treat with waterborne preservatives to minimum retention of 0.25 pcf.
 - 2. Kiln-dry interior dimension lumber after treatment to 19 percent maximum moisture content.
 - 3. Treat wood items indicated and in following circumstances:
 - a. In contact with roofing, flashing, or waterproofing.
 - b. In contact with masonry or concrete.
 - c. Within 18 inches of grade.
- C. Ground Contact Wood Treatment:
 - 1. Pressure treat with waterborne preservatives to minimum retention of 0.40 pcf.

2.07 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

- A. Identify treated wood with appropriate classification marking of Underwriters Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.
- B. Dimension Lumber:
 - 1. Comply with AWWA C20.
 - 2. Treatment Types:
 - a. Interior Type A for protected wood.
 - b. Exterior Type for wood exposed to weather.
- C. Plywood:
 - 1. Comply with AWWA C27.
 - 2. Treatment Types: Interior Type A for protected wood.
- D. Inspect each piece after drying and discard damaged or defective pieces.

PART 3 EXECUTION

3.01 INSTALLATION – GENERAL

- A. Discard units of material with defects that impair quality of miscellaneous carpentry and in sizes that would require excessive number or poor arrangement of joints.
- B. Cut and fit miscellaneous carpentry accurately.
 - 1. Install members plumb and true to line and level.
- C. Coat cut edges of preservative-treated wood to comply with AWWA M4.
- D. Securely fasten miscellaneous carpentry as indicated and according to applicable codes and recognized standards.
- E. Countersink nail heads on exposed carpentry work and fill holes.

- F. Use fasteners of appropriate type and length.
 - 1. Predrill members when necessary to avoid splitting wood.

3.02 WOOD GROUNDS, NAILERS, AND BLOCKING

- A. Install where shown and where required for screeding or attachment of other work.
 - 1. Cut and shape to required size.
 - 2. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading.
 - 1. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION 06 1053

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SECTION 07 1923

WATER REPELLENT/GRAFFITI-RESISTANT COATINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Clear penetrating water repellent/graffiti-resistant coatings for following vertical surfaces:
 - a. Acrylic finish of Portland cement plaster.
 - 2. Clear waterborne silicone emulsion for sealing interior surfaces of concrete unit masonry.
- B. Related Sections:
 - 1. Section 04 2200: Concrete Unit Masonry
 - 2. Section 07 9200: Joint Sealants
 - 3. Section 09 2400: Portland Cement Plaster; acrylic plaster finish.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM D 4261 – Standard Practice for Surface Cleaning Concrete Masonry Units for Coating.
 - 2. ASTM D 5703 – Standard Practice for Preparatory Surface Cleaning for Clay Brick Masonry
- B. South Coast Air Quality Management District (SCAQMD):
 - 1. SCAQMD Rule 1113 – Architectural Coatings.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Include manufacturer's specifications, surface preparation and application instructions.
 - 2. Include following :
 - a. Manufacturer's recommendations for water repellent / graffiti-resistant coatings for each surface to be treated
 - b. Data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.
 - c. Protection and cleaning instructions.
- B. Applicator Certificates:
 - 1. Signed by manufacturer certifying that applicator complies with requirements.
- C. Certification by water repellent/graffiti-resistant coatings manufacturer that products supplied comply with local regulations controlling use of VOC.
- D. Material Test Reports:
 - 1. Indicate and interpret test results for compliance of water repellent/graffiti-resistant coatings with requirements indicated.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Engage experienced applicator who employs only persons trained and approved by water repellent/graffiti-resistant coatings manufacturer for application of manufacturer's products.
- B. Field Samples:
 - 1. Architect will select one representative surface for each substrate to receive water repellent / graffiti-resistant coatings.
 - a. Apply water repellent/graffiti-resistant coatings to each substrate, with either partial or full coverage as directed.
 - b. Comply with application requirements of this Section.
 - 2. Obtain Architect's approval of field samples before applying water repellent / graffiti-resistant coatings.
 - 3. Maintain field samples during construction in an undisturbed condition as standard for judging completed Work.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver liquid materials to Project Site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing.
- B. Store liquid materials in their original undamaged containers in clean, dry, protected location and within temperature range required by siloxane water repellent manufacturer.
 - 1. Store away from heat and open flames.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

1.06 PROJECT CONDITIONS

- A. Weather and Substrate Conditions:
 - 1. Do not proceed with application of water repellent/graffiti-resistant coatings under following conditions, except with written instruction of manufacturer:
 - a. Ambient temperature is less than 40 degrees F.
 - b. Concrete surfaces and mortar have cured for less than 28 days.
 - c. Rain or temperatures below 40 degrees F are predicted within 24 hours.
 - d. Application is earlier than 24 hours after surfaces have been wet.
 - e. Substrate is frozen or surface temperature is less than 40 degrees F.
 - f. Windy condition exists that may cause water repellent/graffiti-resistant coatings to be blown onto vegetation or surfaces not intended to be coated.

1.07 REGULATORY REQUIREMENTS

- A. VOC Classification:
 - 1. Provide materials that comply with South Coast Air Quality Management District (SCAQMD) VOC classification.

1.08 WARRANTY

- A. General Warranty:
 - 1. Special warranty specified in this Article does not deprive Owner of other rights Owner may have under other provisions of Contract Documents and is in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.
- B. Special Warranty:
 - 1. Written warranty, executed by applicator and water repellent/graffiti-resistant coatings manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within specified warranty period.
 - 2. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch wide, fire, vandalism, or abuse by maintenance equipment.
 - 3. Warranty Period: 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Products:
 - 1. Basis of Design:
 - a. Design of water repellent/graffiti-resistant coatings system is based on products as manufactured by ProSoCo, Inc. Lawrence, KS
 - b. Design of sealer for interior surfaces of concrete unit masonry is based on products as manufactured by ProSoCo, Inc. Lawrence, KS
- B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
 - 1. Submit items listed in Article 1.03 and as specified in Section 01 3300, for evaluation of proposed system.
 - 2. Furnish tests results that have been made for identical systems within ranges of specified performance criteria.
 - 3. Copy of manufacturer's 5 year labor and material warranty.

2.02 WATER REPELLENT/GRAFFITI-RESISTANT COATINGS

- A. Clear drying, water-based silicone emulsion for weatherproofing brick, concrete block, and other porous masonry materials.
- B. VOC Compliant Water Repellent/Graffiti-Resistant Coatings:
 - 1. Products complying with local regulations controlling use of VOC, as certified by manufacturer.
 - 2. Blok-Guard & Graffiti Control II by ProSoCo, Inc.

2.03 GRAFFITI REMOVAL PRODUCTS

- A. Low Odor Graffiti Remover:
 - 1. Compliant with specified VOC regulations.

- a. VOC Content: Maximum 30 percent
2. Defacer Eraser Graffiti Wipe or Enviro Klean SafStrip by ProSoCo, Inc.

2.04 INTERIOR MASONRY SEALER

- A. Waterborne silicone emulsion for sealing interior surfaces of concrete unit masonry
 1. Prevents dusting of exposed interior masonry and provide water resistance to applied surface.
 - a. VOC Content: Less than 100 g/L
 2. Dries to clear mattefinish and will not yellow.
 3. Stand Off Interior Masonry Dustproofer by Prosoco, Inc.

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine surfaces to receive water repellent/graffiti-resistant coatings to ensure conditions are satisfactory for application of materials.
- B. Verify that masonry joints found to be unsound, hollow, or otherwise defective, have been raked out to depth of 1/2 inch and pointed with mortar.
- C. Verify that cracks which exceed 1/64 inch wide have been filled with pointing mortar.
- D. Verify that concrete block surfaces with pores greater than 1/64 inch wide have been filled with block filler and cured for three days before applying water repellent / graffiti-resistant coatings.

3.02 PREPARATION

- A. Clean substrate of substances that might interfere with penetration or performance of water repellent/graffiti-resistant coatings.
 1. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.
 2. Concrete Unit Masonry: Clean concrete unit masonry per ASTM D 4261.
 3. Brick Veneer Masonry: Clean brick veneer masonry per ASTM D 5703.
- B. Test for pH level, according to water repellent/graffiti-resistant coatings manufacturer's written instructions, to ensure chemical bond to silicate minerals.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent/graffiti-resistant coatings.
 1. Cover adjoining and nearby painted and finished surfaces when there is possibility of water repellent/graffiti-resistant coatings being deposited on surfaces.
 2. Cover live plants and grass.
- D. Coordination with Sealants:
 1. Do not apply water repellent/graffiti-resistant coatings until sealants for joints adjacent to surfaces receiving treatment have been installed and cured.

- E. Test Application:
1. Before performing water repellent/graffiti-resistant coatings Work, including bulk purchase and delivery of products, prepare small application in unobtrusive location and in manner approved by Architect to demonstrate final effect (visual, physical, and chemical) of planned application.
 2. Proceed with Work only after Architect approves test application or as otherwise directed.
 3. Revisions of planned application, when necessary, as requested by Architect, will be in accordance with Section 01 2610, when they constitute departure from requirements of Contract Documents at time of contracting.

3.03 APPLICATION

- A. Application of Water Repellent/Graffiti-Resistant Coatings:
1. Apply heavy-saturation spray coating of water repellent/graffiti-resistant coatings on surfaces indicated for treatment using low-pressure spray equipment.
 - a. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.
 2. Apply second saturation spray coating, repeating first application.
 - a. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats.
 - b. Consult manufacturer's technical representative when written instructions are not applicable to Project conditions.
- B. Application of Interior Masonry Dustproofer:
1. Before applying, read "Preparation" and "Safety Information" sections in manufacturer's Product Data Sheet.
 - a. Use in concentrate.
 - 1) do not dilute or alter.
 - b. Stir thoroughly before use.
 2. Apply single, wet-on-wet application to provide proper dustproofing while maintaining surface's natural appearance.
 - a. Do not over apply.
 - b. Always test to determine appropriate application rates.
 3. Spray Application – General:
 - a. Saturate surface, spraying from bottom to top.
 - b. Avoid excessive overlapping.
 - c. Let applied material penetrate for 2 to 3 minutes.
 - d. Immediately brush out runs and drips that do not penetrate to prevent build up.
 4. Spray Application: Porous, Textured Surfaces:
 - a. Apply enough material to create 6 to 8 inch rundown below contact point.
 - b. Reapply in same saturating manner to ensure complete coverage of recessed surfaces.
 - c. Immediately brush out runs and drips that do not penetrate to prevent build up.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service:
 - 1. Provide services of factory-authorized technical service representative to inspect and approve substrate before application and to instruct applicator on product and application method to be used.
- B. Spray Test:
 - 1. After water repellent/graffiti-resistant coatings has dried, spray coated surfaces with water.
- C. Recoat surfaces that show water absorption.

3.05 CLEANING

- A. Protective Coverings:
 - 1. Remove protective coverings from adjacent surfaces and other protected areas.
- B. Immediately clean water repellent/graffiti-resistant coatings from adjoining surfaces and surfaces soiled or damaged by application of water repellent/graffiti-resistant coatings as Work progresses.
 - 1. Repair damage caused by application water repellent/graffiti-resistant coatings.
 - 2. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 1923

SECTION 07 4113

METAL ROOF PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Prefinished, prefabricated structural standing seam roof system with continuous interlocking field formed seams.
 - a. Include fasteners and other accessories and components as required for complete installation.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 05 0513: Shop-Applied Coatings for Metal
 - 3. Section 05 5300: Metal Decking
 - 4. Section 06 1053: Miscellaneous Carpentry; wood blocking and nailers.
 - 5. Section 07 2100: Building Insulation
 - 6. Section 07 6200: Sheet Metal Flashing and Trim
 - 7. Section 07 9200: Joint Sealants

1.02 REFERENCES

- A. California Code of Regulations, Title 24, California Building Code (CBC), Part 2, Volumes 1 and 2, current edition
 - 1. CBC Chapter 15 – Roof Assemblies and Rooftop Structures
 - 2. CBC Chapter 33 – Safeguards During Construction,
- B. ASTM International (ASTM):
 - 1. ASTM A 755 – Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
 - 2. ASTM A 792 – Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
 - 3. ASTM D 523 – Standard Test Method for Specular Gloss
 - 4. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
 - 5. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
 - 6. ASTM E 1514 – Standard Specification for Structural Standing Seam Steel Roof Panel Systems
 - 7. ASTM E1592 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
 - 8. ASTM E 1980 – Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- C. International Code Council (ICC):
 - 1. ICC ES – Evaluation Reports:
 - a. ESR-3486

- D. UL, LLC (UL):
 - 1. UL 580 – Standard for Tests for Uplift Resistance of Roof Assemblies
 - 2. UL 2218 – Standard for Impact Resistance of Prepared Roof Covering Materials
- E. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
 - 1. Architectural Sheet Metal Manual.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product specifications, standard construction details, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
 - 2. Include general recommendations, applicable to materials and finishes for each component, and for total panel assemblies.
 - 3. Include erection procedures and instructions.
- B. Shop Drawings:
 - 1. Show layouts and details of panels on roof.
 - 2. Include fabrication and installation layouts of metal panels, showing:
 - a. Details of edge conditions.
 - b. Joints.
 - c. Panel profiles.
 - d. Supports and anchorages.
 - e. Trim, flashing, closures, accessories, and special details.
 - 3. Distinguish between factory and field assembled Work.
 - 4. Accessories:
 - a. Include details of following items at scale of not less than 1-1/2 inches equals 12 inches:
 - 1) Flashing and trim, gutters, and downspouts.
 - 2) Comply with requirements of Section 07 6200.
 - b. Coordinate with requirements of Section 07 5419.
- C. Samples:
 - 1. Minimum of 2 sample panels sets:
 - a. Consisting of 2 panels each, 12 inches long by actual panel width, in profile, style, color, and texture indicated.
 - 1) Show seam construction.
 - b. Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.
- D. Qualification Data:
 - 1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience.
 - 2. Include lists of completed projects with project names and addresses, and names and addresses of architects and owners.
- E. Certified Product Test Reports:
 - 1. Indicate compliance of manufactured roof panel assemblies and materials with performance and other requirements based on comprehensive testing of current products.

2. Following Test Reports, certified by independent testing laboratory or independent professional engineer, to verify that proposed roofing will meet specified performance requirements.
 - a. Thermal Cycle Test.
 - b. ASTM E 1592 – Test Results.
 - c. Clip Fastener Pull-Outs Tests and Calculations.
 - d. Concentrated Load Test Data.
 - e. Coating Performance Testing.
 3. Certified statement from manufacturer attesting to minimum of 15 years experience with roofing systems.
 4. Letter from manufacturer listing installers that are qualified to erect manufacturer's material.
- F. Calculations:
1. Engineering calculations, sealed by registered professional engineer, licensed as structural engineer in State of California, defining cladding loads for roof areas based on design criteria, allowable clip loads, and required number of fasteners to secure panel clips to designated substructure.
 2. Compute uplift loads on clip fasteners with full recognition of prying forces and eccentric clip loading.
 3. Calculate holding strength of fasteners in accordance with submitted test data provided by fastener manufacturer based on length of embedment and properties of materials.
- G. Furnish certified laboratory test reports showing that specified system has been tested and conforms to applicable provisions specified.
- H. Certification by manufacturer that roofing assembly has been successfully tested under UL 580 procedures and has achieved a Class 90 rating.
- I. Maintenance Data:
1. For metal panels, to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
1. Minimum of 15 years experience in architectural roofing design and installation and have permanent indoor production facility.
- B. Installer Qualifications:
1. Experienced installer who has completed metal roof panel projects similar in material, design
 - a. To extent indicated for this Project, with record of successful in-service performance.
 - b. Minimum of 5 years experience in installation of metal roofing systems.
 2. Installer's responsibilities include, but are not necessarily limited to:
 - a. Fabricating and installing metal roof panel assemblies.
 - b. Providing professional engineering services required to assume engineering responsibility.

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3. Engineering Responsibility:
 - a. Preparation of data for metal roof panels, including Shop Drawings and Calculations, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- C. Framing Members Supporting Metal Roof System:
 1. Additions/revisions to framing members supporting Standing Seam Metal Roof System to accommodate manufacturer/fabricator's design are responsibility of Contractor.
 2. Submit additions/revisions to framing members supporting Metal Roof System for Architect's review and acceptance.
- D. Preinstallation Conference:
 1. Conduct preinstallation conference at Project Site, comply with requirements of Section 01 3119 and following:
 - a. Meeting Attendees:
 - 1) Owner
 - 2) Owner's insurer if applicable
 - 3) Project Inspector
 - 4) Architect
 - 5) Metal roof panel installer
 - 6) Metal roof panel manufacturer's representative
 - 7) Structural support, installer
 - 8) Installers whose work interfaces with or affects metal roof panels
 - a) Including installers of roof accessories and roof-mounted equipment.
 - b. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to maintain progress and avoid delays.
 - c. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
 - d. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - e. Review structural loading limitations of deck, purlins, and rafters during and after roofing.
 - f. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
 - g. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - h. Review temporary protection requirements for metal roof panel systems during and after installation.
 - i. Review procedures for repair of metal roof panels damaged after installation.
 - j. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant and other interested parties.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Delivery:
 1. Package panels for protection against damage during transportation or handling.

2. Deliver metal roof panels and other components so they will not be damaged or deformed.
- B. Handling:
 1. Exercise care in unloading, storing, and erecting roof panels to prevent bending, warping, twisting, and surface damage.
- C. Storage:
 1. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering.
 - a. Store metal roof panels to ensure dryness, with positive slope for drainage of water.
 - b. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Leave strippable protective covering on metal roof panels until installation.
 1. Remove as panels are being installed.
 2. Verify film is not left on installed panels.

1.06 PROJECT CONDITIONS

- A. Weather Limitations:
 1. Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements:
 1. Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings.
 2. Coordinate fabrication schedule with construction progress to avoid delaying Work.

1.07 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal roof panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide leakproof, secure, and noncorrosive installation.

1.08 WARRANTY

- A. Warranties:
 1. Special Galvalume Substrate Warranty:
 - a. Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - b. Failures include, but are not limited to, following:
 - 1) Structural failures including rupturing, or perforating.
 - 2) Deterioration of metals and other materials beyond normal weathering.

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- c. Verify available warranties and warranty periods for metal roof panels.
 2. Warranty Period:
 - a. 20 years and 6 months from date of Substantial Completion.
- B. Special Warranty on Roof Panel Finishes:
 1. Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 2. Exposed Panel Finish:
 - a. Deterioration includes, but is not limited to, following:
 - 1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - 2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - 3) Cracking, chipping, peeling, or failure of paint to adhere to bare metal.
 3. Finish Warranty Period:
 - a. 20 years from date of Substantial Completion.
- C. Special Watertightness Warranty:
 1. Manufacturer's standard form, no dollar limit, in which manufacturer agrees to repair or replace standing seam metal roof panel assemblies that fail to remain watertight, including leaks, within specified warranty period.
 - a. Verify available warranties and warranty periods for units and components made by manufacturer listed in Article 2.01 A.
 - b. Warranty Period:
 - 1) 20 years from date of Substantial Completion.
 2. Furnish Shop Drawings to panel manufacturer, for review, and approval prior to panel system installation.
 3. Inspections by panel system manufacturer technical representative are required.
 - a. Perform first inspection when underlayment and flashing are in place and second inspection when roof is complete.
- D. Special Installer Warranty:
 1. Required when requiring Special Watertightness Warranty.
 2. Furnish written warranty signed by panel installer guaranteeing materials and workmanship for watertightness of roofing system, flashings, penetrations, and against leaks.
 3. Warranty Period:
 - a. Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design:
 1. Design of standing seam metal roof system is based upon Zee-Lock Panel System as manufactured by Berridge Manufacturing Company, San Antonio, TX.

- B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
 - 1. Submit items listed in "Submittals" Article and as specified in Section 01 3300, for evaluation of proposed system.
 - 2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
 - 3. Tests shall have been made for identical systems within ranges of specified performance criteria.
 - 4. Copy of manufacturer's 20 year finish and material warranty.

2.02 STANDING SEAM METAL ROOF PANELS

- A. General:
 - 1. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps.
 - a. Include clips, cleats, pressure plates, and accessories required for complete, weathertight installation.
 - 2. Steel Panel Systems:
 - a. Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Vertical Rib, Seamed Joint, Standing Seam Metal Roof Panels:
 - 1. Formed with vertical ribs at panel edges and flat pan between ribs.
 - a. Designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

2.03 MATERIALS

- A. Underlayment Materials:
 - 1. Self-Adhering, High Temperature Underlayment:
 - a. Provide self-adhering, cold-applied, sheet underlayment, minimum of 40 mils thick:
 - 1) Consisting of slip-resistant, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing.
 - 2) Provide primer when recommended by underlayment manufacturer.
 - b. Physical Properties:
 - 1) Thermal Stability:
 - a) Stable after testing at 240 degrees F per ASTM D 1970.
 - 2) Low-Temperature Flexibility:
 - a) Passes after testing at minus 20 degrees F per ASTM D 1970.
 - c. Product and Manufacturer:
 - 1) Grace Ice & Water Shield by GCP Applied Technologies, Inc., Cambridge, MA
 - 2) Lastobond Shield HT, by Soprema, Inc., Wadsworth, OH.
 - 3) Or approved equal.

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2. Slip Sheet:
 - a. Single-ply sheathing paper, manufactured from 100 percent recycled fibers, weighing not less than 3.0 pounds per 100 square feet.
 - b. Product and Manufacturer:
 - 1) Red Rosin Paper as manufactured by W.R. Meadows, Inc., Hampshire, IL
 - 2) Or approved equal.
- A. Metallic-Coated Steel Sheet:
 1. Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792, Class AZ500 coating designation.
 - a. Structural quality.
 - b. Nominal Thickness:
 - 1) 0.025 inch (24 gage), for UL 90 rating.
 2. Exterior Finish:
 - a. Prefinished by coil-coating process complying with ASTM A 755.
 - 1) Provide painted materials with removable plastic film to protect paint finish during roll forming, shipping, and handling.
 3. Panel Coverage:
 - a. Net coverage of 16 inches.
 4. Panel Height: 2.0 inches.
- B. Clips:
 1. Fasten roofing panels to framing members two-piece floating Zee-Clip to accommodate thermal movement.
 2. Material:
 - a. 0.025 inch (24 gage) nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 3. Joint Type: Double folded.
- C. Panel Accessories:
 1. Provide components required for complete panel system including, but not necessarily limited to:
 - a. Trim, copings, fascia, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - b. Match material and finish of metal panels, unless otherwise indicated.
 2. Closures:
 - a. Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 3. Cleats:
 - a. Mechanically seamed cleats formed from minimum 0.0250 inch thick, stainless-steel or nylon-coated aluminum sheet.
 4. Backing Plates:
 - a. Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- D. Gutters, Flashing and Trim:
 1. Provide flashing and trim formed from same material as metal panels as required provide finished appearance.
 2. Conforming to requirements specified in Section 07 6200.

- E. Downspouts:
 - 1. Downspouts are specified in Section 07 6200.
- F. Panel Fasteners:
 - 1. Screws:
 - a. No. 14 diameter self-tapping type with 5/8 inch diameter combination steel and Neoprene "Permaseal" washers;
 - b. Exposed Screws:
 - 1) 300 Series stainless steel, color finished to match panel.
 - c. Concealed Screws:
 - 1) Zinc coated carbon steel or 300 Series stainless steel depending on application requirements.
 - 2. Blind Rivets:
 - a. Solid-threaded sealed seam-type and have weathertight neoprene washer under head.
 - b. Exposed rivet color finished to match panel.
- G. Closures:
 - 1. Provide precut profile closure cut from cross-linked, close-cell, gray polyethylene composition foam.
 - 2. Protect and support ridge foam closures by formed metal closure manufactured from same material, color, and finish as roofing.
 - 3. Factory fabricate ridge closures.
- H. Sealants:
 - 1. Must not contain oil, asbestos, or asphalt.
 - 2. Factory Applied Sidelap Sealant:
 - a. Non-skinning, non-hardening, non-oxidizing butyl sealant, designed for metal-to-metal concealed joints.
 - 3. Field Applied Panel End Sealant:
 - a. Extruded polymeric butyl tape, non-skinning and not easily displaced under compression.
 - 4. Exposed Sealant:
 - a. One component, skinning, nonstaining silicone joint sealant and will not damage panel finish.
 - 1) Comply with requirements of Section 07 9200.
 - 2) Coordinate color with that of panel.
- I. Isolation Material:
 - 1. Provide single-component, inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities; VOC compliant.
 - 2. Elasto-Deck BT as manufactured by Pacific Polymers International, Inc. or equivalent product acceptable to Architect.

2.04 FINISHES

- A. Exterior Finish:
 - 1. Apply following organic coating in thickness indicated.
 - 2. Furnish appropriate air-drying spray finish in matching color for touchup.
 - a. Texture: Smooth

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3. Manufacturer's standard 2-coat, thermocured PVDF system (70 percent Kynar 500/Hylar 5000) consisting of baked-on 0.15-0.20 mil corrosion resistant primer and baked-on 0.70-0.80 mil finish coat with specular gloss of 10-30 percent when tested in accordance with ASTM D 523 at 60 degrees F.
 4. Comply with additional requirements of Section 05 0513 and AAMA 2605
 - a. Durability:
 - 1) Provide coating field tested under normal range of weather conditions for minimum of 20 years
 - a) Without significant peel, blister, flake, chip, crack, or check in finish
 - b) Without chalking in excess of chalk rating of 8 according to ASTM D 4214
 - c) Without fading in excess of 5 Hunter units.
 - b. Color:
 - 1) As selected by Architect from manufacturer's full range.
- B. Interior Finish:
1. Apply following on underside of roof panels
 - a. Primer Coat Material:
 - 1) Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils

2.05 FABRICATION

- A. General:
1. Fabricate and finish metal roof panels and accessories at factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing.
 - a. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, for full length of panel.
- C. Roll forming of panels at Project Site must be performed with manufacturer owned and relocatable industrial type rolling mill having minimum of 12 stands to gradually shape sheet metal.
 1. Installer owned or rented roll formers are not acceptable.
- D. Fasten roof panels to framing members or deck with concealed anchor clips designed to allow for thermal movement of panels except where specific fixed points are indicated.
- E. Install roof panels so that there are no exposed fasteners except to fasten flashings, at fixing points, eaves, ridges, rakes, laps, or as indicated on Drawings.
- F. Sheet Metal Accessories:
1. Fabricate flashing and trim to comply with recommendations in SMACNA Architectural Sheet Metal Manual that apply to design, dimensions, metal, and other characteristics of item indicated.
 2. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

- a. Where single length panels are not practical, provide mated swaged panels for positive joint end laps, shingled to accommodate water run-off.
- 3. Fabricate non-moving seams in accessories with flat-lock seams.
 - a. Tin edges to be seamed, form seams, and solder.
- 4. Sealed Joints:
 - a. Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- 5. Conceal fasteners and expansion provisions where possible.
 - a. Exposed fasteners are not allowed on faces of accessories exposed to
- 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal recommended by metal roof panel manufacturer.
 - a. Size:
 - 1) As recommended by SMACNA Architectural Sheet Metal Manual or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.06 PERFORMANCE REQUIREMENTS

- A. Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturer's standard assemblies similar to those indicated for this Project, by qualified testing and inspecting agency.
 - 1. Provide assemblies conforming to ICC ES Report Number ESR-3486
- B. Structural Performance:
 - 1. Determine structural uniform uplift load capacity of panel system in accordance with test procedures defined in ASTM E 1592 or UL 580, and as follows:
 - a. Factor of Safety on Test Results:
 - 1) 1.65 for panel, batten, or clip ultimate loads with no increase for wind.
 - b. Factor of Safety for Fasteners:
 - 1) 3.0 for one single fastener per clip.
 - 2) 2.25 for two fasteners per clip.
 - 3) 4.0 in masonry.
 - c. Design uplift capacity for conditions of gage, span, or loading other than those tested may be determined by interpolation of test results.
 - 1) Extrapolation of conditions outside range of tests is not acceptable.
 - 2. Deflection:
 - a. L/180 for positive loading.
- C. Air Infiltration:
 - 1. Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 and ASTM E 283 at following test-pressure difference:
 - a. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Water Penetration Under Static Pressure:
 - 1. No water penetration when tested according to ASTM E 1646 and ASTM E 331 at following test-pressure difference:
 - a. Test-Pressure Difference: 15 lbf/sq. ft.
- E. Hydrostatic Head Resistance:
 - 1. No water penetration when tested according to ASTM E2140.

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- F. Wind Uplift Resistance:
 - 1. Provide UL Class 90 rated roofing system, tested in accordance with UL 580 test procedure.
 - 2. Design roof panel system to safely resist positive and negative loads:including wind uplift loads:
 - a. In conformance with 2019 California Building Code, Section 1609, UL 90, and Project documents using exposure "C", importance factor of 1.15 and wind stagnation pressure with basic speed of 70 mph.
- G. Thermal Movements:
 - 1. Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
 - a. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1) Temperature Change (Range):
 - a) 120 degrees F, ambient.
 - b) 180 degrees F, material surfaces.
 - 2. Thermal cycle tested panels minimum of 100,000 cycles with minimum of two inches of movement relative to clip anchor.
 - a. Panels and clips allow that wear will not affect structural performance of system.
- H. FM Global Listing:
 - 1. Provide metal roof panels and component materials complying with requirements in FM Global 4471 as part of panel roofing system and are listed in FM Global "Approval Guide" for Class 1 or noncombustible construction, as applicable.
 - a. Identify materials with FM Global markings.
 - 1) Fire/Windstorm Classification:
 - a) Class 1A-90.
 - 2) Hail Resistance: SH.
- I. Fire Classification:
 - 1. Provide metal roof panels classified as Class A roof covering in accordance with CBC Chapter 15, Section 1505.5.
- J. Provide continuous factory installed hot-melt butyl sealant within confines of panel female flange.
- K. Design panels to withstand 250 lb. concentrated load applied to four square inch area at center of panel at mid-span between supports with no panel deformation, rib buckling, or panel sidelap separation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with installer present, for compliance with requirements for installation tolerances, metal roof panel supports and conditions affecting performance of metal panel roofing.
 - 1. Verify that installation may be made in accordance with approved submittals and manufacturer's instructions.

- a. This specifically includes verifying that secondary structural members and decking are installed to meet UL and CBC requirements.
2. Do not proceed with roof panel installation until unsatisfactory conditions have been corrected.
3. Ensure that structural supports are in place and sag rods, diagonal bracing, and connections are tightened before Work proceeds.

3.02 PREPARATION

- A. Install flashing and other sheet metal to comply with requirements specified in Section 07 6200
- B. Miscellaneous Framing:
 1. Install eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written recommendations.
- C. Field check dimensions and check support alignment with taut string or wire
 1. Support misalignment will cause panel "oil canning" and potentially restrict panel movement.

3.03 METAL ROOF PANEL INSTALLATION

- A. General:
 1. Comply with reviewed submittals and panel manufacturer's written instructions and recommendations for installation, as applicable to Project conditions and supporting substrates.
 2. Anchor panels and other components of Work securely in place, with provisions for thermal and structural movement.
 3. Lap metal flashing over metal roof panels to allow moisture to run over and off material.
 4. Field cutting exterior panels by torch is not permitted.
 5. Install panels with concealed fasteners, unless otherwise indicated.
 - a. Install panels in one continuous length from ridge to eave.
 6. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction.
 - a. Predrill panels.
 7. Provide metal closures at rake edges and each side of ridge caps.
 8. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of openings.
 - a. Fasten with self-tapping screws.
 9. Locate and space fastenings in uniform vertical and horizontal alignment.
 10. Install ridge caps as metal roof panel work proceeds.
 11. Locate panel splices over, but not attached to, structural supports.
 - a. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
- B. Separate dissimilar metals by painting each metal surface in area of contact with specified nonstaining isolation material, by applying rubberized-asphalt underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.

- C. Coat back side of metal panels with isolation material where it will contact, ferrous metal.
- D. Joint Sealant:
 - 1. Install gaskets, joint fillers, and sealants where indicated and where required for performance of panel assemblies.
 - 2. Provide types of gaskets, fillers, and sealants indicated, or when not otherwise indicated, types recommended by panel manufacturer.
 - 3. Flash and seal panels at eave and rake with rubber, neoprene, or other closures.
 - 3. Seal panel end laps with double beads of tape or sealant, full width of panel.
 - 4. Prepare joints and apply sealants to comply with requirements of Section 07 9200
- E. Metal Roof Panels:
 - 1. Fasten metal roof panels to supports with concealed clips at each seam joint at location, spacing, and with fasteners recommended by manufacturer.
 - 2. Install clips to supports with self-tapping fasteners.
 - 3. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 4. Seamed Joint:
 - a. Lap roof panels away from prevailing weather per manufacturer's installation instructions.
 - b. Install butyl tape along sidelaps as recommended by roof panel manufacturer.

3.04 ACCESSORY INSTALLATION

- A. General:
 - 1. Install accessories with positive anchorage to building and provide for thermal expansion.
 - 2. Coordinate installation with flashings and other components.
 - 3. Install components required for complete metal roof panel assembly including trim, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim:
 - 1. Comply with performance requirements, manufacturer's written installation instructions, SMACNA Manual, and Section 07 6200.
 - 2. Provide concealed fasteners where possible.
 - 3. Install work with laps, joints, and seams that will be permanently tight.
 - 4. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
 - 5. Install sheet metal flashing and trim to fit substrates.
 - 6. Expansion Provisions:
 - a. Provide for thermal expansion of exposed flashing and trim.
 - b. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
- C. Gutters:
 - 1. Join sections with riveted and soldered or lapped and sealed joints.

2. Attach gutters not more than 3 feet on center using manufacturer's standard fasteners.
 3. Provide end closures and seal watertight with sealant.
 4. Provide for thermal expansion.
- D. Downspouts:
1. Conform to requirements of Section 07 6200.
 2. Provide fasteners designed to hold downspouts securely 1 inch away from walls
 3. Locate fasteners at top and bottom and at approximately 60 inches on center in between.
 4. Provide elbows at base of downspouts to direct water away from building.

3.05 METAL ROOF INSTALLATION TOLERANCES

- A. Installation Tolerances:
1. Shim and align panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.06 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service:
1. Engage factory-authorized service representative to inspect during construction (as required to meet warranties) and completed metal roof panel installation, including accessories.
 2. Report results in writing.
- B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.
- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 CLEANING AND PROTECTING

- A. Cleaning:
1. Remove temporary protective coverings and strippable films as soon as each panel is installed.
 2. Upon completion of metal roofing installation, clean finished surfaces as recommended by panel manufacturer and maintain in clean condition during construction.
- B. Damaged Units:
1. Protect installed Work from damage.
 2. Replace panels and other components of Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4113

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SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Sheet metal flashing and trim, including, but not necessarily limited to:
 - a. Roofing sheet metal flashing work.
 - b. Reglet and counter flashing assemblies.
 - c. Miscellaneous metal flashing and counter flashing as required
 - d. Drip flashings.
 - e. Other sheet metal items, not necessarily specified, but required to prevent penetration of water into building.
- B. Related Sections:
 - 1. Section 05 0513: Shop-Applied Coatings for Metal
 - 2. Section 06 1013: Miscellaneous Carpentry
 - 3. Section 07 4113: Metal Roof Panels
 - 4. Section 07 9200: Joint Sealants.
 - 5. Section 09 9100: Painting; items specified to be field painted

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. ASTM B 69 – Standard Specification for Zinc Sheet.
 - 3. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants
 - 4. ASTM D 4586 – Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- B. Sheet Metal & Air Conditioning Contractors' National Association (SMACNA):
 - 1. Architectural Sheet Metal Manual
- C. Specialty Steel Industry of North America (SSINA):
 - 1. SSINA Designer Handbook – Standard Practices for Stainless Steel
- D. American National Standards Institute and Single Ply Roofing Institute (ANSI/SPRI):
 - 1. ANSI/SPRI ES-1 – Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
 - a. Testing and Certification Listing of Shop Fabricated Edge Metal and Coping.
 - b. Only required for fabricated item procedures.
- E. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1113: Architectural Coatings
 - 2. Rule 1168 – Adhesive and Sealant Applications

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Showing fabrication, jointing and securing of metal to form flashings and trim.
 - a. Include expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.
 - 2. Identify material, thickness, weight and finish for each item and location in Project.
 - 3. Show Details for:
 - a. Forming sheet metal flashing and trim.
 - 1) Including profiles, shapes, seams and dimensions.
 - b. Fastening, joining, supporting and anchoring sheet metal flashing and trim.
 - 1) Including fasteners, clips, cleats and attachments to adjoining work.
- B. Samples:
 - 1. Each type of sheet metal flashing and trim indicated with factory-applied color finishes.
 - a. Minimum of four 6 inch square samples on same metal used for flashings.

1.04 QUALITY ASSURANCE

- A. Standards:
 - 1. Comply with material and installation requirements of SMACNA Architectural Sheet Metal Manual, unless otherwise indicated or specified.
- B. General:
 - 1. Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, or fastener disengagement.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged.
 - 1. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering.
 - 1. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.06 SEQUENCING

- A. Coordinate metal flashing and trim work with adjacent work, including, but not necessarily limited to:
 - 1. Installation of roofing, waterproofing, drains, piping, blocking, nailers, reglets, framing at openings, curbs and parapets.

- B. Coordinate installation with interfacing and adjoining construction to provide leakproof, secure, and non-corrosive installation.

PART 2 PRODUCTS

2.01 SHEET METAL MATERIALS

- A. Galvanized Steel Sheet:
 - 1. Conforming to ASTM A 653 with G90 coating.
 - 2. Structural quality, minimum 0.0299 inch thickness (22 U.S. standard gage) unless otherwise indicated.
 - 3. Conform to requirements for field painting per Section 09 9100, when not indicated to be prefinished.
- B. Prefinished Metal:
 - 1. Galvanized steel sheet conforming to paragraph A.
 - 2. Coil-Coated Colored Finish:
 - a. Fluoropolymer (Kynar resin-based) coating.
 - b. Comply with requirements in Section 05 0513 for Metal Finish Type B:
 - 1) 1 mil dry film thickness, one side.
 - 2) 0.3 to 0.4 mil on other side.
 - 3. Use in visually exposed locations.
 - 4. Color: As selected by Architect

2.02 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Fasteners:
 - 1. Same metal as flashing/sheet metal or other corrosion resistant metal as recommended by sheet manufacturer.
 - 2. Match finish of exposed heads with material being fastened.
- B. Reglets:
 - 1. Metal units of type and profile indicated, compatible with flashing indicated, corrosion resistant.
 - 2. Fry Reglet Co. "Spring Lok" 2-piece style as indicated; 24 gage galvanized steel.
 - 3. Provide manufacturer's standard prefabricated corner units.
 - 4. Use stainless steel washers with neoprene facing.
 - 5. Equivalent products by MM Systems or Lane-Aire may be used subject to acceptance by Architect.
- C. Metal Accessories:
 - 1. Provide sheet metal clips, straps, anchoring devices and similar accessory unit as required for installation of Work, matching or compatible with material being installed, corrosion resistant, size and gage required for performance.
- D. Epoxy Seam Sealer:
 - 1. 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.
- E. Mastic Sealant:
 - 1. Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

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- F. Isolation Between Dissimilar Materials:
 - 1. Provide single-component, inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities
 - a. VOC compliant.
 - 2. Elasto-Deck BT as manufactured by Pacific Polymers, div. ITW Polymers Sealants North America, or equivalent product acceptable to Architect.
- G. Roofing Cement:
 - 1. Conforming to ASTM D 4586, asphaltic, compatible with roofing materials.
- H. Elastomeric Sealant:
 - 1. Generic type recommended by manufacturer of metal and fabricator of components being sealed
 - 2. Comply with ASTM C 920 and requirements of Section 07 9200.
- I. Flashing Compound:
 - 1. Federal Specification SS-C-153, fibrated asphalt plastic cement, compatible with roofing materials.

2.03 FABRICATION

- A. Sheet metal work is not necessarily individually described.
 - 1. Descriptions included are major items or those requiring detail.
 - 2. Provide other work, as indicated or necessary.
- B. Shop fabricate Work to greatest extent possible.
 - 1. Comply with details shown, applicable requirements of SMACNA Manual, and other recognized industry practices.
 - 2. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of Work.
 - 3. Form work to fit substrates.
 - 4. Comply with material manufacturer instructions and recommendations for forming material.
 - 5. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- C. Seams:
 - 1. Fabricate non-moving seams in sheet metal with flat-lock seams.
 - 2. For metal other than aluminum, tin edges to be seamed, form seams, and solder.
- D. Expansion Provisions:
 - 1. Where lapped or bayonet-type expansion provisions in Work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

- E. Separations:
 - 1. Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with specified isolation coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Counterflashing, Reglets, Copings, and Edgings:
 - 1. In-stock patterns, conforming substantially to details and design as shown, are acceptable.
 - 2. Manufacturers: Fry Reglet Corp., Lane-Aire Corp., or approved equal.

PART 3 EXECUTION

3.01 GENERAL

- A. Inspect substrates and conditions under which metal flashing and trim will be installed.
 - 1. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA Manual.
 - 1. Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units.
 - a. Conceal fasteners where possible, and set units true to line and level as indicated.
 - 2. Install Work with laps, joints and seams which will be permanently watertight and weatherproof.
 - 3. Use fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 4. Anchor sheet metal flashings in accordance with Factory Mutual Loss Prevention Data Sheet 1-49.
 - 5. Drive exposed fasteners through steel/neoprene washers.
- C. Bed flanges of Work in thick coat of specified isolation coating where required for waterproof performance.
- D. Install reglets to receive counter flashing in manner and by methods indicated.
 - 1. Where shown in concrete, furnish reglets to trades of concrete and masonry work for installation as Work of Sections 03 3000 and 04 2000.
 - 2. Install counterflashing in reglets, either by snap-in seal arrangement, or by wedging in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
- E. Metal Protections:
 - 1. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with isolation coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
- F. Install exposed sheet metal flashing and trim without excessive oil canning, buckling and tool marks.

- G. Expansion Provisions:
 - 1. Provide for thermal expansion of exposed flashing and trim.
 - 2. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
 - 3. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- H. Seal joints with elastomeric or butyl sealant as required for watertight construction.
- I. Touch-up abraded areas, where coating has been damaged, with 2 mil coating of paint, specifically recommended by manufacturer for repair of prepainted coatings.

3.02 ROOFING WORK

- A. General:
 - 1. Install sheet metal work and accessories under direct supervision, and to complete satisfaction of roofing installer.
 - 2. Install Work watertight and weathertight throughout.
 - 3. Provide for expansion and contraction, free from undue stress in any part of completed Work using lap-type expansion joints bedded in flashing compound.
- B. For embedment of metal flashing flanges in roofing or composition flashing or stripping, extend flanges for minimum of 4 inch embedment.
- C. Pipe and Conduit Penetrations of Roofing:
 - 1. Flash with zinc flashing.
 - 2. Flanges stripped in by roofer.
 - 3. At short vent pipes, flash per SMACNA, Figure 4-158, with top of flashing turned down 2 inches inside vent pipe.
 - 4. At pipes extending above roof too far to completely cover with zinc, extend zinc flashing up pipe minimum 8 inches and counterflash with storm collar with draw band per SMACNA, Figure 4-15C.
 - a. Seal top of storm collar against pipe with elastomeric sealant.

3.03 CLEANING

- A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.

END OF SECTION 07 6200

SECTION 07 9200

JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Joint sealants required to seal exterior and interior joints to make buildings weather and water tight.
- B. Related Sections:
 - 1. Section 03 3000: Cast-in-Place Concrete
 - 2. Section 04 2200: Concrete Unit Masonry
 - 3. Section 08 1113: Hollow Metal Doors and Frames
 - 4. Section 09 2513: Portland Cement Plaster
 - 5. Section 09 9100: Painting

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants.
 - 2. ASTM C 1193 – Standard Guide for Use of Joint Sealants.
- B. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1168 – Adhesive and Sealant Applications

1.03 SUBMITTALS

- A. Product Data:
 - 1. Technical data sheets on sealants, primers and cleaning agents, including procedures for priming and cleaning
 - 2. Furnish following from each sealant manufacturer for sealants to be used on Project:
 - a. Product recommendations, including sealant, primer, cleaners, backup and bond breaker
 - b. Certification that recommended sealant and related materials meet requirements of this Section
 - c. Approval of Contractor's sealant joint details
 - d. Certification that installed materials will perform satisfactorily when applied in accordance with the manufacturer's applications instructions and Contractor's details
- B. Shop Drawings:
 - 1. Details of each joint type, for each combination of materials and each installation condition, based on recommendations of manufacturer.
 - 2. Indicate following:
 - a. Proposed joint size for each condition, designed to accommodate specified tolerances, building movements and deflections
 - b. Details of dual lines of sealant, indicating vent/weep tube location, zone dams and bridge seals where required.

- C. Sealant Testing Services Reports:
 - 1. Conform to requirements of Article 2.04 A.
 - 2. Reports are to identify cleaning agents, primers and procedures used to obtain satisfactory test results.
 - 3. Furnish following from structural sealant manufacturers:
 - a. Certification that manufacturer has reviewed structural sealant details and tested contact surfaces and finds them suitable for use:
 - 1) With proposed sealant
 - 2) Compatible with and non-staining to surfaces which they will contact.
 - 3) In conformance with requirements of Article 2.01 B and 2.04 A
 - b. Application instructions for sealant, cleaners, primers and related materials, for each installation condition encountered in Project
 - 1) Include surface preparation, quality control procedures, and evaluation of tests performed under Articles 2.04 A.
 - 2) Certification that sealant supplied for Work is same type and quality as that which was tested.
 - 4. Contractor's quality control documentation specified in Article 1.03 E.
 - 5. Reports on field inspections by manufacturer specified in Article 3.04 A.
- D. Samples:
 - 1. Minimum of four, 3 inch long samples of following"
 - a. Sealant: Each type of sealant exposed to view for material and color required (except black).
 - b. Backer Rod and Bond Breaker Tape: each type, for material and color.
- E. Compatibility Tests:
 - 1. Results of each compatibility test to Architect and Contractor for approval prior to start of sealant Work.

1.04 QUALITY ASSURANCE

- A. Use only qualified workers thoroughly skilled and specially trained in techniques of installing sealant, who can acceptably demonstrate to Architect their ability to fill joints solidly and neatly.
- B. Compatibility Tests:
 - 1. Prior to start of sealant Work, conduct compatibility tests of sealant for each different sealing condition and substrate for entire Project performed by sealant manufacturer and sealant installer.
- C. Pre-Installation Meeting:
 - 1. Arrange meeting when sealant contractor and sealant manufacturers have been selected, but prior to award of contracts.
 - 2. Schedule meeting with Owner and General Contractor
 - a. Arrange for attendance by sealant contractor and sealant manufacturer's technical representatives
 - 3. Meeting to include, but not limited to, following:
 - a. Review of preliminary test results on sealants.
 - b. Details of sealant joints.
 - c. Sealant application instruction and training of installers.
 - d. Scheduling and procedures for periodic field inspections by sealant manufacturers' technical representatives.

4. Record minutes of meeting and promptly distribute copies of minutes to attendees and other interested parties as may be necessary.
 - a. Include Architect in distribution of meeting minutes.
 5. Record issues resolved during meeting.
 - a. Include copies of Drawings and application instructions used in meeting.
 - b. Record changes on Drawings and application instructions made at meeting.
- D. Pre-installation Field Testing:
1. Field test adhesion of joint sealant material to Project substrates.
 2. Verify joint sealant materials will satisfactorily adhere to substrates.
 3. Arrange field testing with manufacturer or designated representative.
 4. Notify parties minimum 7 days prior to field testing.
 5. Field test sealants in accordance with ASTM C 1193, Appendix X-1, Method A – "Field Applied Sealant Joint Hand-pull Tab" in compliance with manufacturer's recommendations.
- E. Quality Control Documentation:
1. Establish and administer written procedure for documenting sealant Work, including:
 - a. Log in each shipment of sealant received, by lot number and date received
 - b. Record dates and results of field tests specified in Article 3.04 C
 - c. Log out each lot of sealant installed or rejected, and its ultimate location in Work, when installed.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project Site in original unopened containers bearing manufacturer's name, product designation, date of manufacture and mixing instructions.

1.06 WARRANTY

- A. Warrant sealants against loss of adhesion, loss of cohesion, cracking, or discoloration for period of twenty years; include labor and material to replace defective sealant

PART 2 PRODUCTS

2.01 MATERIALS

- A. Sealant Standards – General:
1. Elastomeric Sealant: Manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated, complying with requirements of ASTM C 920, including those referenced for Type, Grade, and Class.
- B. Silicone Sealant:
1. Silicone construction sealant, certified by manufacturer to meet following criteria:
 - a. Has physical properties required for both structural and non-structural uses under installed conditions
 - b. Has appropriate movement capability for installation conditions

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- c. Is suitable for interior and exterior application in joint conditions shown
 - d. Will produce watertight bond and watertight joints
 - e. Is compatible with other materials which sealant will contact
 2. Primer, backup, and bond breaker-products recommended by sealant manufacturer
 - a. Primer is required unless manufacturer's installation instructions specifically advise to contrary for certain materials
 3. Sealant manufacturer is to recommend use of products which will perform satisfactorily under installation conditions on Work.
 - a. Product recommendation is to include sealant, primer, backup, bond breaker, surface preparation, installation methods, and evaluation of tests performed under Article 3.04 A
- C. Sealant for Paving Joints:
 1. Self-leveling polyurethane, pouring grade, for gun application.
 2. Suitable for traffic service
 3. Primer, backup, and bond breaker-products recommended by manufacturer
- D. Compatibility:
 1. Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- E. VOC Content of Interior Sealants:
 1. Provide sealants and sealant primers for use inside building envelope that comply with following limits for VOC content complying with SCAQMD Rule 1168:
 - a. Architectural Sealants: Not more than 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.
 - c. Sealant Primers for Porous Substrates: Not more than 775 g/L
- F. Colors:
 1. Provide colors as scheduled or selected by Architect for various combinations of materials which form joints.
 2. Provide transparent sealant where specified
- G. **Sealant No. 1:**
 1. Silicone rubber based, one-part, low-modulus, non-acid curing sealant; Type S, Grade NS, Class 100/50.
 2. Provide one of following product:
 - a. DOWSIL 790 by Dow Silicones.
 - b. General Electric Silpruf SCS2700 by Momentive Performance Products
 - c. Pecora 890NST by Pecora Corp.
 - d. Sikasil WS-290 by Sika Corporation.
 3. Apply Sealant No.1 to following exterior joints:
 - a. Joints between metal frame and cast-in-place concrete, or masonry
 - b. Joints between cast-in-place concrete sections
 - c. Vertical expansion and control joints
 - d. Horizontal ceiling/soffit joints
 - e. Sills, jambs, and heads of window frames, door frames, louvers and similar openings, and where metal, wood, or other materials abut or join concrete, or each other

- f. Other exterior joints
 - 4. Apply Sealant No. 1 to following interior joints:
 - a. Hidden metal to metal storefront joints expected to undergo minimal movement
 - b. Under door thresholds
 - c. Vertical expansion and control joints
 - d. Horizontal ceiling/soffit joints
- H. **Sealant No. 2:**
 - 1. Two-Component Polyurethane Sealant:
 - a. Type M, Grade P, Class 25.
 - 2. Provide one of following products:
 - a. Pacific Polymers Elasto-Thane 227/227R by ITW Polymers Sealants North America, Inc.
 - b. MasterSeal SL 2 Sealant by BASF Corporation, Construction Systems
 - c. Urexpan NR-200 by Pecora, Corp.
 - d. Sikaflex-2C SL by Sika Corporation
 - 3. Apply Sealant No.2 to following exterior joints:
 - a. Horizontal control and expansion joints in concrete slabs and concrete paving
 - 4. Apply Sealant No.2 to following interior joints:
 - a. Horizontal control and expansion joints in concrete slabs and tile flooring.
- I. **Sealant No.4:**
 - 1. Silicone rubber based, one-part, medium-modulus, neutral curing sealant; Type S, Grade NS, Class 50.
 - 2. Provide one of following products:
 - a. DOWSIL 756 SMS by Dow Silicones.
 - b. GE SCS9000 SilPruf NB by Momentive Performance Products.
 - c. Pecora 864NST by Pecora Corp.
 - d. Sikasil WS-605 S by Sika Corporation
 - 3. Apply Sealant No.4 to following exterior joints:
 - a. Vertical expansion and control joints in tile and concrete.
 - b. Horizontal ceiling/soffit joints
 - c. Other exterior joints where non-staining sealant is required.

2.02 MISCELLANEOUS MATERIALS

- A. Joint Primer:
 - 1. Provide type of joint primer recommended by sealant manufacturer for joint surfaces to be primed or sealed.
- B. Bond Breaker Tape:
 - 1. Polyethylene tape or other plastic tape as recommended by sealant manufacturer to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant.
 - 2. Provide self-adhesive tape where applicable.
- C. Sealant Backer Rod:
 - 1. Compressible rod stock of polyethylene foam, polyethylene jacketed polyurethane foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended by sealant manufacturer for compatibility with sealant.

2. Provide products by one of following, or approved equal.
 - a. Denver Foam by Backer Rod Mfg. Inc.
 - b. Sof-Rod by Nomaco, Inc.
 - c. Sealtight Kool-Rod by W.R. Meadows, Inc.

2.03 SOURCE QUALITY CONTROL

- A. Provide sealant materials of each type to be product of one manufacturer throughout Project.

2.04 PERFORMANCE AND TESTING REQUIREMENTS

- A. Non-Structural Sealant Tests:
 1. Perform testing in accordance with ASTM or other acceptable recognize standards
 2. Provide sealant manufacturer's laboratory test results on current production sealant for applicable characteristics and properties listed in ASTM C 920, Section 8
 3. Provide sealant manufacturer's laboratory test results on recommended products applied on materials which will form joints in actual building construction
 4. Make adhesion tests and bleed/stain tests on each material which forms joints to be sealed
 5. Provide tests and information on compatibility of sealant with glazing materials and other accessory materials which may be in contact with sealant
 6. Results of manufacturer's tests are to be available with certification specified in 1.03 C and for the preconstruction meeting specified in 1.04 C.
 7. Acceptable Test Results:
 - a. Peel Adhesion Strength:
 - 1) Minimum 15 pounds per linear inch when tested according to ASTM C 794, with results reported after following cure conditions:
 - 2) 7 day dry cure
 - a) 14 day dry cure
 - b) 14 day dry plus 1 day wet cure
 - c) 14 day dry plus 7 day wet cure
 - b. Bleed/Stain: No visible bleeding or staining on exposed materials in contact with sealants

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine joints, with installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance.
 1. Correct improper conditions.

3.02 JOINT PREPARATION

- A. Remove dirt, insecure coatings, moisture, and other substances which could interfere with bond of sealant.

- B. Prepare joint surfaces, prime as required and install backup, and bond-breaker immediately before installation of sealant.
 - 1. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer.
 - 2. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.
- C. Prime joint surfaces where recommended by sealant manufacturer.
 - 1. Do not allow primer to spill or migrate onto adjoining surfaces.

3.03 INSTALLATION OF SEALANT

- A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.
- B. Set joint filler units at proper depth or position in joint to coordinate with other work, including installation of bond breakers, backer rods and sealant.
 - 1. Do not leave voids or gaps between ends of joint filler units.
- C. Install sealant backer rod for sealants, except where recommended to be omitted by sealant manufacturer for application indicated.
- D. Install bond breaker tape where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.
- E. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete wetting of joint bond surfaces equally on opposite sides.
 - 1. Except as otherwise indicated, fill sealant rabbet to slightly concave surface, slightly below adjoining surfaces.
 - 2. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form slight cove, so that joint will not trap moisture and dirt.
 - 3. Tool joints to form smooth, uniform beads with slightly concave surfaces, with finished joints straight, uniform, smooth and neatly finished.
 - 4. Remove excess sealant from adjacent surfaces of joint, leaving work in neat, clean condition.
 - 5. Do not use tooling agents unless recommended by sealant manufacturer.
- F. Coordinate installation of backup and sealant with other work as it progresses.
 - 1. Seal joints before adjacent surfaces are waterproofed or painted.
- G. Perform Work under conditions required by sealant manufacturer's application instructions, including training of installers
 - 1. Make test applications of sealants under direction of sealant manufacturer's technical representative
 - 2. Run neat, full beads without voids
 - 3. Use sufficient pressure to force sealant against internal surfaces of joints
 - 4. Tool sealant faces to smooth surface sealed to adjacent materials
 - 5. Do not stain or overrun adjacent materials
 - a. Use masking or other protection as necessary

- H. Install sealant to depths recommended by sealant manufacturer but within following general limitations, measured at center (thin) section of bead:
 - 1. For sidewalks, pavements and similar joints sealed with elastomeric sealant and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but neither more than 1/2 inch deep nor less than 3/8 inch deep.
 - 2. For normal moving joints sealed with elastomeric sealant but not subject to traffic, fill joints to depth equal to 50 percent of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.
 - 3. For joints sealed with non-elastomeric sealants, fill joints to depth in range of 75 percent to 125 percent of joint width.
- I. Where irregular surface or sensitive joint border exists apply masking tape at edge of joint to insure joint neatness and protection.
 - 1. Remove masking tape after sealant is applied.
- J. Spillage:
 - 1. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.
 - 2. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- K. Recess exposed edges of exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.
- L. Bond ends of joint filler together with adhesive or join by other means as recommended by manufacturer to ensure continuous watertight performance.

3.04 FIELD QUALITY CONTROL

- A. Testing Services:
 - 1. Owner will provide services of testing laboratory to make tests of field installed sealant
 - 2. Cooperate with laboratory personnel and provide materials and facilities required for testing
 - 3. Work found to be deficient is to be removed and replaced at Contractor's expense
 - 4. Costs for additional inspection and testing resulting from investigating and retesting deficient work will be paid by Contractor.
- B. Field Inspections by Sealant Manufacturer:
 - 1. Periodic field inspections performed by sealant manufacturer's technical representative.
 - 2. Include representative's certification that sealant was properly installed in accordance with application instructions
 - 3. Identify improper Work which was discovered and describe changes in application instructions for later work
 - 4. Furnish final inspection report on completed Work, and certification to Owner that sealant was properly installed
- C. Field Testing by Contractor:
 - 1. Perform field tests on each lot of sealant received for tack-free time and proper curing.

2. Conform to the sealant manufacturer's instructions
3. Document results by lot number in quality control log

3.05 PROTECTION AND CLEANING

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of substantial completion.
 1. When, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealant immediately and reseal joints with new materials to produce joint sealant installations with repaired areas indistinguishable from original work.
- B. Clean off excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 07 9200

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SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Hollow metal doors and frames as indicated and scheduled.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 04 2200: Concrete Unit Masonry
 - 3. Section 07 9200: Joint Sealants
 - 4. Section 09 2216: Non-Structural Metal Framing

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition
 - 1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.
- B. American National Standards Institute (ANSI)/ Steel Door Institute (SDI):
 - 1. ANSI/SDI A250.4 – Test Procedure and Acceptance Criteria for – Physical Endurance for Steel Doors, Frames, and Frame Anchors
 - 2. ANSI/SDI A250.6 – Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
 - 3. ANSI/SDI A250.8 – Specifications for Standard Steel Doors and Frames (SDI-100)
 - 4. ANSI A250.10 – Test Procedure and Acceptance Criteria for Prime Painted Steel Doors and Frames.
 - 5. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames.
 - 6. SDI 117 – Manufacturing Tolerances for Standard Steel Doors and Frames.
- C. ASTM International (ASTM):
 - 1. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 2. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM A1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - 4. ASTM A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Door and frame assemblies, including reinforcing and provisions for hardware as shown and specified.
 - 2. Drawings indicate profile and general details of steel frame fabrication and installation.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data for each type of door and frame indicated.
 - a. Including, but not necessarily limited to following:
 - 1) Door designation
 - 2) Type, level, and model
 - 3) Material description
 - 4) Core description
 - 5) Construction details
 - 6) Finishes.
- B. Shop Drawings:
 - 1. Showing fabrication and installation of steel doors and frames.
 - a. Including, but not limited to following:
 - 1) Details of each frame type
 - 2) Elevations of door design types
 - 3) Conditions at openings
 - 4) Details of construction
 - 5) Location and installation requirements of finish hardware and reinforcements.
 - 6) Details of joints and connections.
 - 2. Show anchorage and accessory items.
- C. Samples:
 - 1. Provide samples of door and frame construction only upon request of Architect.
 - 2. Hollow Metal Frame:
 - a. Corner section of typical exterior and interior frame, of sufficient composite size to illustrate following:
 - 1) Corner joint construction.
 - 2) Hinge reinforcement.
 - 3) Closer reinforcement.
 - 4) Floor anchor, dust cover, and jamb anchors showing galvanizing and prime coat finishes.
 - 3. Hollow Metal Door:
 - a. Section of typical interior door of sufficient composite size to illustrate:
 - 1) Edge, top, and bottom.
 - 2) Core construction
 - 3) Hinge reinforcement and face stiffening
 - 4) Closer and kick plate reinforcement
 - 5) Corner of vision opening construction with glazing beads.

- D. Certification:
 - 1. Certification of compliance with referenced standards and specified criteria, including but not necessarily limited to:
 - a. Physical Endurance in accordance with ANSI A250.4
 - b. Prime Paint performance in accordance with ANSI A250.10, and as specified.
- E. Door Schedule:
 - 1. Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum documented experience of more than five years providing hollow metal doors and frames for similar size projects.
- B. Coordinate with hardware supplier for fabrication of doors and frames to receive hardware items.
- C. Quality Standards:
 - 1. Provide steel doors and frames complying with referenced standards as follows:
 - a. ANSI/SDI A250.4
 - b. ANSI/SDI A250.8
 - c. ANSI A250.10

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cartoned or crated to provide protection during transit and Project storage.
- B. Inspect doors and frames upon delivery for damage and notify shipper and supplier should damage be found.
 - 1. Minor damages may be repaired provided refinished items are equal with respect to new work and acceptable to Architect.
 - 2. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at Project Site under cover.
 - 1. Place units on minimum 4 inch high wood blocking.
 - 2. Avoid using non-vented plastic or canvas shelters that could create humidity chamber.
 - 3. Should door packaging become wet, remove cartons immediately.
 - 4. Provide minimum 1/4 inch spaces between stacked doors to permit air circulation.

1.07 WARRANTY

- A. Furnish manufacturer's 1 year material and workmanship warranty.
- B. Furnish installer's 2 year labor warranty.

1.08 REGULATORY REQUIREMENTS

- A. Fire-Rated Door Assemblies:
 - 1. Assemblies complying with NFPA 80, labeled and listed by UL, Intertek Group, or another testing and inspection agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
- B. Fire-Rated Window Assemblies:
 - 1. Assemblies complying with NFPA 80, listed and labeled by testing and inspection agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
- C. Accessibility:
 - 1. Conform to requirements of CBC Chapter 11B, Section 11B-404

1.09 WARRANTY

- A. Furnish manufacturer's 1 year material and workmanship warranty.
- B. Furnish installer's 2 year labor warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, provide products by one of following, or approved equal:
 - 1. ASSA ABLOY Door Security Solutions.
 - 2. Door Components, Inc.
 - 3. Steelcraft; division of Allegion
- B. Materials, Fabrication, and Installation:
 - 1. Comply with requirements of standards referenced in "Quality Assurance" Article.

2.02 MATERIALS

- A. General:
 - 1. Steel thicknesses meeting minimum requirements of ASTM standards and as described in ANSI/SDI A250.8.
- B. Hot Rolled Steel Sheets:
 - 1. ASTM A 1011, Commercial Steel (CS), Type B.
 - a. Free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic Coated Steel Sheets:
 - 1. ASTM A 653, Commercial Steel (CS), Type B.
 - a. A40 zinc-iron-alloy (galvannealed) coating
 - b. Stretcher-leveled standard of flatness.
- D. Cold Rolled Steel Sheets:
 - 1. ASTM A 1008, Commercial Steel (CS)
 - a. Suitable for exposed applications, Type B.

- b. Stretcher-leveled standard of flatness.
- E. Supports and Anchors:
 - 1. Fabricate from minimum 16 gage sheet steel unless noted otherwise.
 - 2. After fabricating, galvanize units to be built into exterior walls according to ASTM A 153, Class B.
- F. Inserts, Bolts, and Fasteners:
 - 1. Provide as shown on Drawings and to suit conditions of secure installations.
 - 2. Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153.
 - 3. Furnish Type 304 stainless steel fasteners at exterior doors.
- G. Sound Deadener:
 - 1. Spray-on type, non-combustible and non-bleeding
 - a. INC DC-10 Noise Dampening Compound by Industrial Noise Control, Inc., or approved equal

2.03 DOORS

- A. General:
 - 1. Provide type and size of doors shown with louvers and openings for glazing where indicated.
 - 2. Minimum Door Thickness: 1-3/4 inches.
- B. Interior Doors:
 - 1. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI A250A for physical endurance level:
 - a. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
 - 1) 0.053 inch (16 gage) thick faces.
- C. Exterior Doors:
 - 1. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI A250A for physical endurance level:
 - a. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
 - 1) 0.053 inch (16 gage) thick faces.

2.04 FRAMES

- A. General:
 - 1. Provide fully welded steel frames for doors that comply with ANSI/SDI A250.8 and with details indicated for type and profile.
 - 2. Conceal fastenings, unless otherwise indicated.
- B. Frames of 0.067 inch (14 gage) thick steel sheet for:
 - 1. Level 3 steel doors.
 - 2. Wood doors

- C. Plaster Guards:
 - 1. Provide 0.016 inch thick, steel sheet plaster guards or mortar boxes to close off interior of openings
 - 2. Place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.
- B. Supports and Anchors:
 - 1. Fabricated from not less than 0.042 inch thick, electrolytic zinc-coated or metallic-coated steel sheet.

2.02 SOURCE QUALITY CONTROL

- A. Provide hollow metal doors and frames as products of single manufacturer.

2.03 FABRICATION

- A. General:
 - 1. Fabricate steel door and frame units to comply with ANSI/SDI A250.8 to be rigid, neat in appearance, and free from defects including warp and buckle.
 - 2. Where practical, fit and assemble units in manufacturer's plant.
 - 3. Clearly identify work that cannot be permanently factory assembled before shipment, to ensure proper assembly at Project Site.
- B. Exterior Door Construction:
 - 1. Fabricate doors and frames from metallic coated steel sheet for exterior locations and elsewhere as indicated,.
 - 2. Close top and bottom edges of doors flush as integral part of door construction by addition of 0.053 inch thick, metallic coated steel channels with channel webs placed even with top and bottom edges.
- C. Core Construction:
 - 1. Vertical Steel Stiffeners:
 - a. Stiffen door face sheets with continuous vertical-formed steel (rib) sections.
 - 1) Minimum 20 gage.
 - 2) Full thickness of interior space between door faces.
 - 3) Space 6 inches on center maximum.
 - 4) Spot weld to both faces at 4 inches on center maximum.
 - 2. Core Insulation:
 - a. Provide sound deadening and insulating material through entire core of door.
 - 1) Full height, width, and thickness of door.
 - b. Provide STC ratings where indicated on Drawings, scheduled, or for partition ratings indicated on Drawings.
 - c. Provide doors having minimum sound transmission classification of 28 as tested under ASTM E 90 and ASTM E 413, unless noted otherwise.
 - d. Provide exterior doors meeting or exceeding required thermal rating indicated, scheduled, or for wall rating.
- D. Clearances for Non-Fire Rated Doors:
 - 1. Not more than 1/8 inch at jambs and heads, and not more than 1/8 inch between pairs of doors.
 - 2. Not more than 3/4 inch from bottom of door to top of concrete slab.

- E. Single-Acting, Door Edge Profile:
 - 1. Beveled edge.
- F. Tolerances:
 - 1. Comply with SDI 117 – Manufacturing Tolerances for Standard Steel Doors and Frames.
- G. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold or hot rolled steel sheet.
- H. Hardware Preparation:
 - 1. Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier.
 - 2. Comply with applicable requirements in ANSI A250.6 and ANSI A 115 specifications for door and frame preparation for hardware.
- I. Frame Construction:
 - 1. Fabricate frames to profiles shown with mitered or coped, continuously welded corners and seamless face joints
 - 2. For Exterior Applications:
 - a. Fabricate frames from metallic coated steel sheet, with mitered or coped, continuously welded corners and seamless face joints.
 - b. Provide continuously welded 12 gage closure plate of bottom of exterior frames.
 - 3. Provide welded frames with temporary spreader bars.
 - a. Do not remove until frames are installed, unless otherwise directed.
 - 4. Sound Deadener:
 - a. Apply sound deadener to concealed surfaces of frames in accordance with manufacturer's instructions.
 - b. Produce effective sound deadening for each application.
- J. Supports and Anchors:
 - 1. Fabricate from minimum 16 gage, galvanized steel sheet.
 - 2. Refer to details indicated on Drawings.
 - a. Floor Anchors: Minimum thickness:
 - 1) 12 gage galvanized steel sheet or bent steel plate, securely fastened inside each jamb, with two holes in anchor at each jamb for 3/8 inch floor anchorage fasteners.
 - b. For preframed wood stud walls provide an additional wood stud anchor located as close to bottom of jamb as practical.
 - c. Where required at sloping and uneven floor conditions, or to coordinate adjustments for trim alignments, provide adjustable floor anchors, providing at least 2 inch height adjustment.
 - 3. Jamb Anchors – General:
 - a. Locate anchors near top and bottom and at intermediate points not to exceed 24 inches on center.
 - b. Provide 2 anchors per head for openings up to 48 inches wide.
 - c. Openings over 48 inches wide provide anchors at 24 inches on center maximum.
 - 4. Anchors in Metal Stud Partitions:
 - a. Provide steel anchors, 16-gage minimum sheet steel, of design to suit partition construction, securely welded inside each jamb.

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- 5. Through-Frame Anchors:
 - a. At frames indicated to be anchored with bolts through frame, provide countersunk holes for bolts with 16 gage minimum sheet steel stiffeners full thickness of frame, and securely welded inside each frame at each hole.
- K. Inserts, Bolts, and Fasteners:
 - 1. Manufacturer's standard units,
 - a. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153, Class C or D as applicable.
- L. Head Reinforcing:
 - 1. Reinforce internally with full length, 10 gage angles on each side of frame and bar at bottom of stop for closer reinforcement in frames.
 - 2. Do not allow reinforcing to act as lintel or load-carrying member.
 - 3. Provide at frames regardless of whether or not closer is specified.
- M. Hardware Reinforcement and Accessories:
 - 1. Reinforce doors and frames to receive surface applied hardware.
 - a. Drilling and tapping for surface applied hardware may be done at Project Site.
 - b. Butt Hinge:
 - 1) Minimum 7 gage, 4 inches longer than height of hinge.
 - c. Continuous Hinge:
 - 1) Minimum 14 gage continuous strip reinforcing.
 - d. Door Closers:
 - 1) Minimum 14 gage channel, 6 inches high on each side of door.
 - 2) Extend reinforcement full width of door.
 - e. Accomplish Reinforcing for other items of finish hardware according to ANSI A250.6
 - 2. Locate hardware as indicated on Shop Drawings
 - a. Where not indicated, locate according to ANSI/SDI A250.8, except where modified by requirements of CBC, Section 1008.1.9.2.

2.04 FINISHES

- A. Shop Prime Finish:
 - 1. Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.
 - 2. Coordinate with Paint Systems in Section 09 9100 to ensure compatibility with field applied finish coats.

PART 3 EXECUTION

3.01 INSTALLATION – GENERAL

- A. Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as specified.

3.02 FRAME INSTALLATION

- A. Comply with provisions of SDI-105 – Recommended Erection Instructions for hollow metal frames, unless otherwise indicated.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
2. Anchor frames in wood frame partitions with manufacturer recommended anchors.
3. Upon completion of wall construction, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - a. Except for frames located at in-place concrete installations, place frames prior to construction of enclosing walls and ceilings.
4. In existing concrete construction, anchor frames with galvanized anchor bolts 3/8 inch diameter, counter-sunk at 24 inches on center.
 - a. Provide at least three completed opening anchors per jamb.
 - b. Install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb.
 - c. Set frames and secure to adjacent construction with bolts
5. Install fire-rated frames in accordance with UL Listings and according to NFPA 80.

3.03 DOOR INSTALLATION

- A. Install hollow metal doors complying with ANSI/SDI A2S0.B and in accordance with manufacturer's installation instructions.
 1. Coordinate with Work of other trades.
- B. Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI A2S0.8.
 1. Fire Rated Doors:
 - a. Install to ensure that door and jamb clearances comply with UL Listings, with clearances specified in NFPA 80.
 2. Shim as necessary to comply with SDI-122 and ANSI/DHI A 115.1G.
- C. Adjust operable parts for correct function.
- D. Remove hardware, except prime coated items, tag, box, and install after finish painting has been completed.

3.04 PRIME COAT TOUCH-UP

- A. Prime Coat Touch-Up:
 1. Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air drying primer.

3.05 REPAIR, ADJUST, AND CLEAN

- A. Repairs:
 1. Fill surface depressions, including countersunk fasteners, with metallic paste filler
 2. Allow to thoroughly cure, sand flush, and smooth for invisible appearance with adjacent metal surfaces.
- B. Protection Removal:
 1. Immediately before final inspection, remove protective wrappings from doors and frames.

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- C. Final Adjustment:
 - 1. Check and readjust operating finish hardware items, leaving hollow metal doors and frames undamaged and in complete and proper operating condition.
- D. Remove and legally dispose of rubbish, debris and waste materials off Project Site.

3.06 PROTECTION

- A. Protect Work until Substantial Completion.

END OF SECTION 08 1113

SECTION 08 3323

OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Exterior overhead coiling doors where indicated and scheduled.
 - 2. Method of Operation:
 - a. Chain operated.
 - b. Provide slide bolts at door bottom.
- B. Related Sections:
 - 1. Section 04 2200: Concrete Unit Masonry; wall construction.
 - 2. Section 05 5000: Metal Fabrications; steel support framing and anchorage.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A 36 – Standard Specification for Carbon Structural Steel.
 - 2. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- B. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
 - 1. ASCE/SEI 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Wind Loading:
 - a. Design and reinforce exterior overhead coiling doors to withstand wind loading pressure of 20 psf.
 - 2. Cycle Life:
 - a. Design doors of standard construction for normal use of up to 20 cycles per day maximum, and an overall maximum of 50,000 operating cycles for the life of the door.
 - 3. Seismic Performance:
 - a. Provide manufacturer's seismic calculations confirming ASCE 7.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data, roughing-in diagrams and installation instructions for each type and size of overhead coiling door.
 - 2. Include operating instructions and maintenance data.
- B. Shop Drawings:
 - 1. For special components and installations which are not fully dimensioned or detailed on manufacturers data sheets.

1.05 QUALITY ASSURANCE

- A. Furnish each overhead coiling door as complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.
- B. Furnish overhead coiling door units by one manufacturer for entire Project, unless otherwise acceptable to Architect,
- C. Inserts and Anchorages:
 - 1. Furnish inserts and anchoring devices which must be built into wall construction for installation of units.
 - 2. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.
 - 3. Coordinate delivery with other work to avoid delay.
- D. Wind Loading:
 - 1. Design and reinforce exterior overhead coiling doors to withstand wind loading pressure of 20 psf.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis-of-Design:
 - 1. Design of overhead coiling door is based on Model ESD10, as manufactured by Cornell Iron Works, Inc., Mountain Top, PA
- B. Subject to compliance with specified requirements, provide named product or comparable product by one of following:
 - 1. Clopay Building Products Company, Inc.
 - 2. The Cookson Co.
 - 3. Overhead Door Corporation.
 - 4. Wayne-Dalton Corporation.

2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtain:
 - 1. Interlocking slats designed to withstand specified wind loading, of continuous length for width of door without splices.
 - 2. Unless otherwise shown or specified, provide slats of material gage recommended by door manufacturer for size and type of door required, and as follows:
 - 3. Steel Door Curtain Slats:
 - a. Structural quality, cold-rolled, galvanized steel sheets with G90 zinc coating, complying with ASTM A 653.
 - b. Furnish manufacturer's standard flat-face slats.
- B. Endlocks:
 - 1. Heavy malleable iron castings, secured to curtain slats with 2 galvanized rivets.
 - 2. Provide locks on alternate curtain alignment and resistance against lateral movement.

- C. Bottom Bar:
 - 1. Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick.
 - 2. Locking:
 - a. Locate slide bolts on interior side of door.
- D. Gasket:
 - 1. Provide replaceable gasket of flexible vinyl or neoprene between angles as weather seal and cushion bumper.
- E. Curtain Jamb Guides:
 - 1. Steel shapes with sufficient depth and strength to retain curtain against specified wind loading.
 - 2. Build-up units with minimum 3/16 inch thick steel, of sections complying with ASTM A 36.
 - 3. Slot bolt holes for track adjustment.
- F. Weather Seals:
 - 1. Provide natural rubber or neoprene rubber weatherstripping for exterior exposed doors except where otherwise noted.
 - 2. Secure weather seals with continuous metal pressure bars.
 - 3. At door heads, use 1/8 inch thick continuous sheet secured to inside of curtain coil hood.
 - a. At door jambs, use 1/8 inch thick continuous strip secured to exterior side of jamb guide.

2.03 COUNTERBALANCING MECHANISM

- A. Counterbalance doors by means of adjustable steel helical torsion spring, mounted around steel shaft and mounted in spring barrel and connected to door curtain with required barrel rings.
 - 1. Use grease-sealed ball bearings or self-lubricating graphite bearing for rotating members.
- B. Counterbalance Barrel:
 - 1. Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of curtain without distortion of slats and limit barrel deflection to not more than 0.03 inch per foot of span under full load.
 - 2. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs.
 - a. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel.
 - b. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.
 - 3. Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold fixed spring ends and carry torsional load.
- C. Brackets:
 - 1. Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

- D. Hood:
 - 1. Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weather seal.
 - 2. Contour to suit end brackets to which hood is attached.
 - 3. Roll and reinforce top and bottom edges for stiffness.
 - 4. Provide closed ends for surface mounted hoods
 - a. Provide intermediate support brackets as required to prevent sag.
 - 5. Steel:
 - a. Fabricate steel hoods for doors of not less than 24 gage hot-dip galvanized steel sheet with 1.25 oz. commercial zinc coating, complying with ASTM A 653.

2.04 MANUAL DOOR OPERATOR

- A. Chain Hoist Operator:
 - 1. Provide manual chain hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and geared reduction unit with maximum 35 pounds pull for door operation.
 - a. Design chain hoist with self-locking mechanism allowing curtain to be stopped at any point in its travel and remain in position until movement is reactivated.
 - b. Furnish cadmium plated alloy steel hand chain with chain holder secured to operator guide.

2.05 FINISHES

- A. Powder-Coat Applied Finish:
 - 1. Apply manufacturer's standard powder-coat-applied finish consisting of primer and topcoats according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
 - 2. Color and Gloss:
 - a. As selected by Architect from manufacturer's full range of colors and gloss.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Set track, door and operating equipment complete with required hardware, jamb and head mold strips, anchors, inserts, hangers and equipment supports in accordance with final shop drawings, manufacturer's instructions, and as specified.
- B. After installation, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion, with weathertight fit.

3.02 DEMONSTRATION

- A. Startup Services:
 - 1. Engage factory-authorized service representative to train Owner's maintenance personnel as specified below:
 - a. Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, preventive maintenance.

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- b. Review data in maintenance manuals.
 - 1) Refer to additional requirements specified in Section 01 7700
- c. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 08 3323

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SECTION 08 9100

LOUVERS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Types of louvers include following:
 - a. Exterior extruded aluminum, sightproof, drainable blade wall louvers.
 - 2. Extent of louvers is indicated, including indications of sizes and locations.
 - a. Coordinate requirements, quantities and sizes with Mechanical Drawings.
 - b. Exterior wall louvers not shown on Architectural Drawings, but indicated on Mechanical Drawings are part of Work of this Section.
- B. Related Sections:
 - 1. Section 05 0513: Shop-Applied Coatings for Metal; factory finish on aluminum louvers.
 - 2. Section 07 9200: Joint Sealants
- C. Related Requirements:
 - 1. Refer to Division 23 Sections for louvers in mechanical Work.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- B. Air Movement and Control Association (AMCA):
 - 1. AMCA Standard 500 – Test Method for Louvers, Dampers, and Shutters.
 - 2. AMCA Publication 261 – Directory of Licenses Products, current edition.
- C. Sheet Metal and Air Condition Contractors National Association (SMACNA)
 - 1. SMACNA – Architectural Sheet Metal Manual, current edition
- D. American Architectural Manufacturer's Association (AAMA):
 - 1. AAMA Standard 2605 – Voluntary Specification, Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications and installation instructions for required products, including finishes.
- B. Shop Drawings:
 - 1. For fabrication and erection of louver units and accessories.
 - 2. Include following:

- a. Plans, elevations and details of sections and connections to adjoining Work.
 - b. Include anchorages, accessories, and finishes.
 - c. Include information necessary for fabrication and installation of louvers.
- 3. Indicate materials, sizes, thickness, fastenings, profiles, fasteners, joinery, and other information to determine compliance with specified requirements.
- C. Samples:
 - 1. Each type of metal finish required, prepared on samples of same thickness and material indicated for final Work.
- D. Quality Assurance Submittals:
 - 1. Certified Test Reports:
 - a. Showing compliance with specified performance characteristics and physical properties.
 - 2. Certified Test Results:
 - a. From approved testing laboratory showing that proposed louvers meet specified criteria.
 - 3. Performance Certificates:
 - a. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.

1.04 QUALITY ASSURANCE

- A. Performance Requirements:
 - 1. Where louvers are indicated to comply with specific performance requirements, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA) Standard 500.
 - 2. AMCA Certification:
 - a. Provide louvers with AMCA Certified Ratings Seal evidencing that product complies with above requirement.
- B. Comply with SMACNA – Architectural Sheet Metal Manual recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.
- C. Field Measurements:
 - 1. Verify size, location and placement of louver units prior to fabrication, wherever possible.
- D. Shop Assembly:
 - 1. Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints, and field assembly of units.
 - 2. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations.
 - 3. Clearly mark units for reassembly and coordinated installation.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - 1. Deliver, store, and handle products to avoid distortion or damage due to moisture, physical abuse or other causes.
 - 2. Furnish louvers free from nicks, scratches and blemishes.
 - 3. Replace defective or damaged materials with new.

1.06 PROJECT CONDITIONS

- A. Field Measurements:
 - 1. Verify actual measurements/openings by field measurements before fabrication.
 - 2. Show recorded measurements on shop drawings.
 - 3. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.07 WARRANTY

- A. Manufacturer's Warranty:
 - 1. Manufacturer's standard warranty document executed by authorized company official.
 - 2. Manufacturer's warranty is in addition to, and not limitation of, other rights Owner may have under General Conditions of the Contract.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis-of-Design:
 - 1. Design for extruded aluminum wall louvers is based on characteristics of Model A6097H Single Drainable Mullion Louver as manufactured by Construction Specialties, Inc., Cranford, NJ.
- B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 016000 and following:
 - 1. Submit items listed in Article 1.03 and as specified in Section 01 3300, for evaluation of the proposed items.
 - 2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.

2.02 MATERIALS

- A. Aluminum Sheet:
 - 1. Conforming to ASTM B 209 Alloy 3003 or 5005.
 - a. With temper as required for forming, or as otherwise recommended by metal producer to provide required finish.
- B. Aluminum Extrusions:
 - 1. Conforming to ASTM B 221, Alloy and Temper 6063-T52.

- C. Fastenings:
 - 1. Use same material as items fastened, unless otherwise indicated.
 - 2. Fasteners for exterior applications may be stainless steel or aluminum.
 - 3. Provide types, gauges, and lengths to suit unit installation conditions.
 - 4. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Anchors and Inserts:
 - 1. Use non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance.
 - 2. Use steel or lead expansion bolt devices for drilled-in-place anchors.
- E. Isolation Between Dissimilar Materials:
 - 1. For concealed locations, provide single-component, inert-type non corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities
 - a. VOC compliant.
 - 2. Elasto-Deck BT as manufactured by Pacific Polymers, division of ITW Polymers Sealants North America, Inc., or equivalent product acceptable to Architect.

2.03 SOURCE QUALITY CONTROL

- A. Source Limitations:
 - 1. Obtain louvers and vents through one source from single manufacturer where alike in one or more respects regarding type, design, or factory-applied color finish.

2.04 FABRICATION – GENERAL

- A. Provide louvers and accessories of design, materials, sizes, depth, arrangement, and metal thicknesses indicated.
 - 1. As required for optimum performance with respect to following:
 - a. Airflow.
 - b. Water penetration.
 - c. Strength.
 - d. Durability.
 - e. Uniform appearance.
 - 2. Size:
 - a. Fabricate louvers in exterior walls to outside dimensions indicated, with allowance of 3/8 inch on each side for sealant joints.
 - b. Verify sizes with final HVAC shop drawings.
 - 1) Include detail dimensions of ductwork, dampers, or other fittings abutting louvers.
 - c. Louver Depth: 6 inches
- B. Field Measurements:
 - 1. Verify size, location and placement of louver units prior to fabrication.
- C. Shop Assembly:
 - 1. Fabricate frames to minimize field adjustments, splicing, mechanical joints, and field assembly of units.
 - 2. Fabricate frames to suit adjacent construction with tolerances for installation.

- a. Include application of sealants in joints between louvers and adjoining work.
 3. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling.
 - a. Clearly mark units for reassemble and coordinated installation.
 4. Join frame members to one another and to stationary louver blades by welding.
 - a. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
 5. Include supports, anchorages, and accessories required for complete assembly.
- D. Provide insect screens for exterior louvers.

2.05 SIGHTPROOF DRAINABLE BLADE WALL LOUVER

- A. Sightproof Drainable Blade Louver:
1. Units designed to collect and drain water to exterior at sill by means of gutters in front edges of blades, and channels in jambs and mullions.
 2. Furnish units with extrusions not less than 0.063 inch thick, of depth, and sizes indicated, complying with following performance requirements:
 - a. Free Area:
 - 1) Nominal: 57.6 percent
 - 2) Coordinate with requirements indicated on Mechanical Drawings.
 - b. Static Pressure Loss:
 - 1) Not more than 0.15 inch of water gage at airflow of 1,050 fpm free area velocity in intake direction.
 - c. Water Penetration:
 - 1) Not more than 0.05 oz. per sq. ft. of free area at airflow of 1000 fpm free area velocity.
 - d. Coordinate air-handling louvers with duct work.

2.06 LOUVER INSECTSCREENS

- A. Provide removable screens for exterior louvers where indicated.
1. Fabricate screen frames of same metal and finish as louver units to which secured, unless otherwise indicated.
- B. Provide rewirable frames consisting of formed or extruded metal with driven spline or insert for securing screen mesh.
- C. Use insect screens where indicated.
1. 18 by 14 inch mesh of 0.015 inch grey fiberglass.
- D. Locate screens on inside face of louvers.
1. Secure screens to louver frames with machine screws, spaced at each corner and at 12 inches on center between.

2.07 METAL FINISHES

- A. Aluminum Finish:
1. High-Performance Coating:
 - a. Comply with requirements for Metal Finish Type A for extrusions as specified in Section 05 0513.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry construction.
 - 1. Coordinate delivery of such items to Project Site.

3.02 EXAMINATION

- A. Site Verification:
 - 1. Verify substrate conditions, previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install louvers in accordance with manufacturers approved shop drawings and as shown.
 - 1. Locate and place louver units plumb, level, and in proper alignment with adjacent Work.
 - 2. Provide necessary fastenings and anchors required for complete installation.
 - a. Use concealed anchorages wherever possible.
 - b. Provide neoprene or nylon washers fitted to screws where required to protect metal surfaces.
 - 3. Form tight joints with exposed connections accurately fitted together.
 - a. Fit exposed connections accurately.
 - b. Provide reveals and openings for sealants and joint fillers, as indicated.
- B. Repair finishes damaged by installation operations required for fitting and jointing.
 - 1. Restore finishes so there is no evidence of corrective work.
 - 2. Return items which cannot be refinished in field to shop.
 - a. Make required alterations, and refinish entire unit, or provide new units, at Contractor's option.
- C. Protect non-ferrous metal surfaces from corrosion or galvanic action by application of heavy coating of isolation material on surfaces which will be in contact with Portland cement plaster or dissimilar metals.
- D. Provide concealed gaskets, flashings, joint fillers, and insulation.
 - 1. Install as Work progresses to make installations weathertight.

3.04 PROTECTION

- A. Protect louvers from damage from subsequent building operations.

3.05 CLEANING

- A. Remove and legally dispose of debris, rubbish, and waste material off Project Site.

END OF SECTION 08 9100

SECTION 09 0562

MOISTURE VAPOR EMISSION CONTROL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Preparation of designated areas and installation of Moisture Vapor Emission Control System
- B. Related Sections:
 - 1. Section 01 4525: Concrete Moisture Testing
 - 2. Section 03 3000: Cast-in-Place Concrete; under-slab vapor retarder and concrete floor sealers.
 - 3. Section 09 6500: Resilient Flooring

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C307 – Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
 - 2. ASTM C579 – Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - 3. ASTM C580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - 4. ASTM D2240 - Standard Test Method for Rubber Property—Durometer Hardness
 - 5. ASTM D7234 – Standard Test Method for Pull-Off Strength of Coatings on Concrete Using Portable Adhesion Testers
 - 6. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials
- B. Military Specifications (MIL):
 - 1. MIL-D-3134J – Deck Covering Materials

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications on cured system and individual components of Flooring System.
 - a. Include data on physical and performance properties showing conformance with specified requirements in Article 2.01 D.
 - 2. Furnish information in quantities as specified in Section 01 3300.
- B. Certifications:
 - 1. Moisture Vapor Emissions Control System manufacturer's written approval of installer.

- C. Copy of manufacturer's packing slip, tagged for this specific Project, along with calculations, signed by officer of primary material supplier demonstrating that quantity of material furnished for Project will achieve specified coverage and mil thickness.
- D. Samples:
 - 1. Minimum of four 6 inches x 6 inches cured system sample for verification purposes and finish texture approval.

1.04 QUALITY ASSURANCE

- A. Pre-Installation Meeting:
 - 1. Schedule meeting with Owner, Architect, Independent Testing Agency, and Construction Manager
 - a. Comply with requirements of Section 01 3119.
 - b. Arrange for attendance by floor covering installers and floor covering manufacturers' technical representatives.
 - 2. Meeting to include, but not limited to, following:
 - a. Review of calcium chloride, relative humidity, and pH test results on floor slabs.
 - b. Adhesive application instruction.
 - c. Scheduling and procedures for periodic field inspections by floor covering manufacturers' technical representatives.
 - 3. Record minutes of meeting and promptly distribute copies of minutes to attendees and other interested parties as may be necessary.
 - 4. Record issues resolved during meeting
 - a. Include copies of Drawings and application instructions used in meeting
 - b. Record changes on Drawings and application instructions made at meeting.
- B. Manufacturer's Qualifications:
 - 1. Obtain materials from single manufacturer with minimum of 5 years verifiable experience providing materials of type specified.
- C. Installer Qualifications:
 - 1. Installer employing skilled mechanics having not less than three years satisfactory experience in installation of type of system specified, and approved in writing by system manufacturer.
- D. Moisture Vapor Emissions Control System Thickness Verification:
 - 1. At Owner's discretion and under supervision by his Project Inspector, take one inch random cores per 1,000 square feet through system into substrate to verify proper system thickness.
 - 2. Remove and replace cored areas less than specified thickness or increase in thickness by installer, in manner that does not affect performance or integrity of system.
 - 3. Build up cored areas that comply with recommended system thickness to match surrounding surface elevation prior to applying seal coats.
 - 4. As cores taken and patched will be noticeable, take cores in areas where aesthetics are less critical.
 - 5. Perform coring and patching in accordance with requirements of Section 01 7329.

6. Cost associated with repair of cored areas that comply with specified thickness is responsibility of Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver primary system materials in manufacturer's undamaged, unopened containers.
 1. Clearly mark each container with following:
 - a. Product name and number.
 - b. Manufacturer's name
 - c. Component designation (A, B, and so on)
 - d. Product Mix Ratio
 - e. Health and Safety Information
 - f. CHEMTREC Emergency Response Information
- B. Provide equipment and personnel to handle materials by methods that prevent damage.
 1. Promptly inspect direct Project Site material deliveries to ensure that quantities are correct, comply with specified requirements, and are not damaged.
- C. Responsibility for materials furnished by Contractor rests with Contractor.
 1. Replace, at Contractor's expense, such materials that are found to be defective in manufacture or that have become damaged in transit, handling, or storage.
- D. Store materials in accordance with manufacturer's instructions, with seals and labels intact and legible.
 1. Maintain temperatures within required range.
 2. Do not use materials that exceed manufacturer's maximum recommended shelf life.

1.06 PROJECT CONDITIONS

- A. Site Visit:
 1. Prior to installation of Moisture Vapor Emission Control System visit Project Site to evaluate substrate condition, quantity and severity of cracking, and extent of repairs needed.
 2. Repair substrate imperfections only after mechanical preparation of substrate.
 3. Testing of concrete slabs is specified in Section 01 4525.
 4. Verify that moisture vapor transmission of substrate does not exceed Moisture Vapor Emission Control System manufacturer's recommendations.
 5. Costs associated with repair, leveling, and remediation of substrate are responsibility of Contractor
- B. Exercise care during surface preparation and system installation to protect surrounding substrates and surfaces, and in-place equipment.
 1. Prepare substrate to remove laitance and open surface achieved by light brush grit blasting.
 2. Produce surface profile similar to medium grit sandpaper and free from bond inhibiting contaminants.
 3. Costs incurred that are associated with damage from negligence or inadequate protection are sole responsibility of Contractor.

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- C. Slab Temperature:
 - 1. Condition slab to minimum 50 degrees F before commencing installation, during installation, and for at least 72 hours after installation is complete.
 - 2. Substrate temperature must be at least 5 degrees F above dew point during installation.
- D. Maintain lighting at minimum uniform level of 50 or more foot candles in areas where Moisture Vapor Emission Control System is being installed.
 - 1. When practicable, it is recommendation of manufacturer that permanent lighting be in place and working during installation.
- E. Correct leaks from pipes and other sources prior to installation of Moisture Vapor Emission Control System.

WARRANTY

- F. Contractor and manufacturer to jointly furnish standard guarantee of moisture vapor emission control system for period of one year after date of Substantial Completion.
 - 1. Labor and material guarantee includes loss of bond and wear-through to concrete substrate from normal use.
- G. Damage due to structural design deficiencies including, but not limited to, slab cracking from lateral, vertical or rotational movement, and gouging or other damage due to fork lifts, other equipment, Acts of God, or other elements beyond scope of protection of system nor causes not related to the system materials are not covered by warranty.
- H. In event of warranty claim, Owner will notify manufacturer and contractor in writing within 30 days of first appearance of problems covered under warranty.
 - 1. Owner will provide free and unencumbered access to area during normal working hours for warranty rework.
 - 2. Property protection is also Owner's responsibility.
 - a. Remedy is limited to direct repair of Moisture Vapor Emission Control System.

PART 2 PRODUCTS

2.01 MOISTURE VAPOR EMISSION CONTROL SYSTEM

- A. Basis-of-Design:
 - 1. Design of Moisture Vapor Emission Control System is based on KOSTER VAP I 2000 Moisture Mitigation System as manufactured by KOSTER American Corporation, Virginia Beach, VA
 - 2. System consists of one of following:
 - a. KOSTER VAP I® 2000 Zero VOC - 12 hour setting time, Zero VOC 2-part epoxy resin coating
 - 3. Color: Amber
- B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
 - 1. Submit items listed in Article 1.04 and as specified in Section 01 3300, for evaluation of proposed system.

2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
 3. Copy of manufacturer's material warranty.
- C. Conform to following physical properties:
1. Adhesion, ASTM D 7234: 350 psi, concrete failure
 2. Hardness, ASTM D 2240, Shore D: 80
 3. Tensile Strength, ASTM C 307: 1,200 psi
 4. Compressive Strength, ASTM C 579: 5,800 psi
 5. Flexural Strength, ASTM C 580: 1,200 psi
 6. Permeability, ASTM E 96: Less than 0.09 perms
 7. Impact Resistance, MIL-D-3134J: Greater than 160 in/lb (160 lb load)
- D. Provide at floor slabs scheduled to receive adhesive applied floor finishes such as carpet, vinyl composition tile, or other floor coverings, indicated in Finish Schedule, where concrete moisture testing indicates non-compliance with flooring manufacturer's requirements for moisture vapor emissions.

PART 3 EXECUTION

3.01 MOISTURE VAPOR EMISSION CONTROL SYSTEM INSTALLATION

- A. Surface Preparation:
1. Abrasive blast concrete surfaces to remove surface contaminants and laitance.
 2. Prepare concrete surface with profile of CSP 3-4.
 - a. Refer to manufacturer's Form G-1 – Instruction for Concrete Surface Preparation
 3. Following initial preparation, inspect concrete for bug holes, voids, fins, and other imperfections.
 - a. Grind protrusions smooth
 - b. Fill voids with system compatible filler.
 - c. For treatment of:
 - 1) Cracks in concrete substrates:
 - a) Refer to manufacturer's publication – Concrete 102.
 - 2) Control joints in concrete substrate:
 - a) Refer to manufacturer's publication – Concrete 103.
- B. Installation Conditions:
1. Throughout application process, maintain substrate temperature between 50 degrees F to 90 degrees F.
 2. Substrate temperature must be at least 5 degrees F above dew point.
 3. Perform application on concrete substrate while temperature is falling to lessen off-gassing.
 4. Isolation/Expansion and Other Joints Subject to Movement:
 - a. Address expansion joints through flooring system.
 - b. Refer to manufacturer's publication – Concrete 105.
- C. Application:
1. Apply to flat concrete slabs-on-grade and upper level slabs, scheduled to receive adhesive applied floor finishes.
 2. Apply to concrete slabs after curing and drying in strict conformance with manufacturer's instructions and recommendations.

3. Do not apply material in direct sunlight.

3.02 CURING

- A. Cure materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of installation and prior to completion of curing process.
 1. Allow to cure 18 hours minimum before applying subsequent flooring systems.
 2. Cure times vary depending on environmental conditions.

3.03 CLEANING

- A. Clean up mixing and application equipment immediately after use with water.
 1. Observe fire and health precautions when handling or storing solvents.
- B. Clean system just prior to inspection and installation of succeeding floor coverings, using materials and procedures suitable to system manufacturer.
 1. Follow manufacturer's recommendations for testing and types of cleaners.

3.04 PROTECTION

- A. Protect installed system from damage and wear during other phases of construction operation, using temporary coverings as recommended by manufacturer, as required.
 1. Remove temporary covering just prior to installation of succeeding floor coverings.

END OF SECTION 09 0562

SECTION 09 2513

PORTLAND CEMENT PLASTER

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Portland Cement Plaster Acrylic-Based Finish Coat applied to concrete unit masonry.
 - a. Includes crack isolation system.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 04 2200: Concrete Unit Masonry
 - 3. Section 07 9200: Joint Sealants
 - 4. Section 09 9100: Painting; painting of Portland cement plaster.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
 - 1. Chapter 25 – Gypsum Board, Gypsum Panel Products, and Plaster
- B. ASTM International (ASTM):
 - 1. ASTM C 926 – Standard Specification for Application of Portland Cement Based Plaster
 - 2. ASTM D 1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
 - 3. ASTM D 4216 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly (Vinyl Chloride) (CPVC) Building Products Compounds
 - 4. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
 - 5. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials

1.03 SYSTEM DESCRIPTION

- A. Crack Isolation System (CIS):
 - 1. System consists of:
 - a. Polymer-modified, cementitious base coat, minimum 1/6 inch thick, applied over substrate.
 - b. Woven fiberglass mesh is then fully embedded in the base coat and troweled smooth, ensuring that no mesh is visible.
 - c. Approved finish coat is applied over dry base coat.
- B. Acrylic-Based Finish Coat:
 - 1. Consisting of 100 percent acrylic-based finish.
 - a. Providing flexible, durable, integrally colored finish.

- b. Acrylic-based finish may be sprayed or troweled to achieve specified texture.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product data and installation instructions for each product specified.
- B. Material Certificates:
 - 1. Producer's certificate for each kind of plaster aggregate indicated evidencing that materials comply with requirements.
- C. Samples:
 - 1. Prepare four 18 inch square sample plaques using materials and workmanship indicating proposed range of colors and texture to be expected in completed Work.
 - a. Submit to Architect and obtain acceptance of color and texture.
 - b. Accepted sample is to be used in construction of mock-ups.
 - 2. Do not begin construction of mock-up until samples have been reviewed and accepted by Architect.

1.05 QUALITY ASSURANCE

- A. Comply with CBC, Chapter 25.
- B. Mock-Ups:
 - 1. Prior to installing plaster work, construct panels for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.
 - 2. Construct mock-ups to comply with following requirements, using materials indicated for final unit of Work:
 - a. Locate mock-ups on-site in location and of size indicated or, when not indicated, as directed by Architect.
 - b. Erect mock-ups consisting of minimum 4 by 4 foot panel by full thickness in presence of Architect using materials, including crack isolation system (CIS), and control joints, indicated for final Work.
 - 1) Include one corner condition with corner trim.
 - c. Notify Architect 7 days in advance of dates and times when mock-ups will be constructed.
 - d. Demonstrate proposed range of color aesthetic effects and workmanship expected in completed Work.
 - 1) Obtain Architect's acceptance of visual qualities of sample panel.
 - 3. Obtain Architect's acceptance of mock-ups before start of plaster Work.
 - 4. Retain and maintain mock-ups during construction in undisturbed condition as standard for judging completed Portland cement plaster work.
 - 5. When directed, remove mock-ups from Project Site.
 - a. Accepted mock-ups in undisturbed condition at time of Substantial
 - 6. Completion may become part of completed unit of Work.
- C. Contact local architectural representative/technical consultant of plaster finish manufacturer to provide consultation with installer for application of finish on samples, mock-ups and during actual system application.

- D. Pre-Installation Meeting:
 - 1. Conduct meeting one week prior to construction of mock-ups at Project Site.
 - 2. Meeting should be attended by Architect, Contractor, applicator of plaster system, and manufacturer's technical representative.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver manufactured materials in original packages, containers or bundles, bearing name of manufacturer and brand.
- B. Keep plaster and cementitious materials dry until ready for use.
 - 1. Keep off ground, under cover, and away from damp surfaces.
 - 2. Protect metal goods against rusting.

1.07 PROJECT CONDITIONS

- A. Exterior Plaster Work – General:
 - 1. Before, during, and following application of plaster system, ambient and surface temperatures must remain above 40 degrees F for minimum period of 24 hours.
 - 2. Do not apply plaster when ambient temperature is below 40 degrees F.
 - 3. Inclement Weather:
 - a. Protect applied material from inclement weather until dry.
- B. Cold-Weather Requirements:
 - 1. Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application.
 - 2. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.
- C. Warm Weather Requirements:
 - 1. Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial.
 - 2. Apply and cure plaster as required by climatic and project conditions to prevent dry out during cure period.
 - 3. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.
- D. Protect contiguous work from soiling, spattering, moisture deterioration and other harmful effects which might result from plastering.

1.08 WARRANTY

- A. Portland Cement Plaster with Acrylic Modified Finish Coat.
 - 1. Warranty Period:
 - a. Seven years from date of Substantial Completion
- B. Installer's Warranty:
 - 1. Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design:
 - 1. Design of Portland cement plaster system is based Crack Isolation System (CIS) with OmegaFlex Acrylic-based finish coat as manufactured by Omega Products International, Inc., Corona, CA.
- B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
 - 1. Submit items listed in Article 1.04 and as specified in Section 01 3300, for evaluation of proposed system.
 - 2. Copy of manufacturer's material warranty.

2.02 PLASTER ACCESSORIES FOR PORTLAND CEMENT PLASTER

- A. General:
 - 1. Coordinate depth of accessories with thicknesses and number of coats required.
 - 2. Comply with material provisions of ASTM D 1784 and D 4216 for following:
 - a. Provide PVC products as manufactured by Plastic Components, Inc., or approved equal.
 - 3. Do not use metal accessories with Acrylic Modified Plaster finish except where PVC type is not available, subject to Architect's review and acceptance.
- B. Metal Corner Reinforcement:
 - 1. Expanded large mesh diamond mesh lath fabricated from zinc-alloy or welded wire mesh fabricated from 0.0475 inch diameter zinc-coated wire, specially formed to reinforce external corners of Portland cement plaster on exterior exposures while allowing full plaster encasement.
 - 2. Bullnose Corner Reinforcing:
 - a. Complying with ASTM A 653.
 - b. 7/8 inch radius Bullnose Corner Aid.
- C. Corner Beads:
 - 1. Small nose corner beads fabricated from PVC, with 2-1/2 inch to 2-3/4 inch flanges of PVC to allow full encasement by plaster.
- D. Casing Beads:
 - 1. Square-nose style of PVC, with 1-3/4 inch flange and removable protective tape.
- E. Control Joints:
 - 1. Prefabricated of PVC.
 - 2. One-Piece Type:
 - a. Folded pair of non-perforated screeds in M-shaped configuration, with 3-3/8 inch flanges.
 - 3. Two-Piece Type:
 - a. Pair of casing beads with back flanges formed to provide slip joint action, adjustable for joint widths from 1/8 inch to 5/8 inch.
 - 4. Match control joints in plaster with control joints in concrete unit masonry.

- F. Foundation Weep Screed:
 - 1. Fabricated from PVC, with weep holes, 3-1/2 inch flange.

2.03 PORTLAND CEMENT PLASTER MATERIALS

- A. Portland Cement Acrylic Finish:
 - 1. 100 percent acrylic-based finish using latest Dirt Pick-up Resistance (DPR) technology, formulated with high quality acrylic resins, graded quartz aggregates, and proprietary additives.

2.04 MISCELLANEOUS MATERIALS

- A. Water for Mixing and Finishing Plaster:
 - 1. Drinkable, free of substances capable of affecting plaster set or of damaging plaster, lath or accessories.
- B. Bonding Agent for Portland Cement Plaster:
 - 1. Conforming to ASTM C 932.
- C. Miscellaneous Aluminum Moldings and Trim:
 - 1. As manufactured by Fry Reglet Corp., or approved equal:
 - 2. Style type indicated on Drawings.
 - 3. Aluminum moldings:
 - a. Extruded alloy 6063-T5.
 - b. Provide with end caps.
 - 4. Factory Finish:
 - a. Factory applied prime coat, unless indicated otherwise.
 - 5. Install in accordance with manufacturer's recommendations.
 - 6. Field Finish:
 - a. Field paint in accordance with specified system in Section 09 9100.
 - b. Contractor's Option:
 - 1) Provide factory baked enamel finish coating in color as selected by Architect.

2.05 PROPORTIONING AND MIXING

- A. Thoroughly mix finish materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.
 - 1. Mechanically mix at Project Site.
 - a. Thoroughly mixed prior to use with paddle mixer.

2.06 ACRYLIC-FINISH COAT OVER CONCRETE MASONRY

- A. Crack Isolation Base:
 - 1. Polymer-Modified Cementitious Base Coat.
 - 2. Omega CI-Base
- B. Crack Isolation Mesh:
 - 1. Omega Reinforcing Mesh:
 - a. Alkali Resistant, Woven Fiber Mesh.
 - 1) CI-Mesh Standard Mesh (4.5oz).
 - 2) Omega Crack Isolation (CI) Mesh.

- C. Primer:
 - 1. Acrylic Priming Agent.
 - a. Omega RapidPrime.
- D. Acrylic-Based Finish Coat:
 - 1. Acrylic Modified Plaster:
 - a. Basis of Design:
 - 1) OmegaFlex System by Omega Products International, Inc.
 - 2. Finish Coat:
 - a. OmegaFlex Medium 100 percent acrylic-based finish.
 - 1) Color and texture to match approved mock-up.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to application of Portland cement system, review Site with plastering contractor to ensure that:
 - 1. Surface and Site conditions are ready to receive Work.
 - 2. Grounds and Blocking:
 - b. Verify that items within walls for other sections of Work have been installed.
- B. Substrates:
 - 1. Acceptable substrates must be securely fastened per applicable building code requirements.
 - 2. Acceptable substrates and adjacent materials must be dry, clean, and sound.
 - a. Substrate surface must be flat, free of fins or planar irregularities greater than 1/4 inch in 10-feet.
- C. Flashings:
 - 1. Flashing around windows, at deck attachments, utility penetrations, roof lines, and kick-out flashing must be properly installed prior to application of Portland cement plaster system.
- D. Report unsatisfactory conditions to Contractor, Architect, and Owner.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.
 - 2. Beginning of installation constitutes acceptance of existing conditions.

3.02 PREPARATION – GENERAL

- A. Substrate:
 - 1. Clean substrate to which Portland cement plaster system is to be applied.
 - a. Ensure that there are no foreign materials present.
 - 1) Including, but not necessarily limited to:
 - a) Oil, dirt, dust, form release agents, efflorescence, paint, wax, water repellants, moisture, frost, or extended nails that may rupture water-resistive barrier.
- B. Surrounding Areas:
 - 1. Protect surfaces near Work of this Section from damage, disfiguration, and overspray.
 - a. Mask off dissimilar materials.

3.03 PLASTERING ACCESSORIES

- A. General:
 - 1. Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated.
 - 2. Miter or cope accessories at corners:
 - a. Install with tight joints and in alignment.
 - 3. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.
- B. Accessory Attachment:
 - 1. Attach each flange at 18 inches on center maximum, or as necessary to hold plumb, for vertical accessories and to coincide with framing for horizontal accessories.
- C. Set accessories plumb, level and true to line, with tolerance of 1/8 inch in 10 feet.
- D. Install metal or PVC corner beads at external corners as required.
- E. Install casing beads at terminations of plaster work, except where plaster is indicated to pass through other work and be concealed by lapping work, and except where special screens, bases or frames act as casing beads including interior metal door frames.
 - 1. For exterior work, set casing beads 1/4 inch from abutting frames and other work, for application of sealant.
- F. Control and Expansion Joints:
 - 1. Install control and expansion joints at locations indicated, or where not indicated, at locations complying with following criteria and approved by Architect:
 - a. Where expansion or control joint occurs in surface of construction directly behind plaster membrane.
 - b. Where distance between control joints in Portland cement plastered surface exceeds 10 feet in either direction.
 - c. Where area within Portland cement panels exceed 100 square feet.
 - d. Where Portland cement plaster panel sizes or dimensions change.
 - 1) Extend joints full width or height of plaster membrane.
 - 2. Install prefabricated expansion joints of 2-piece design where shown as "Expansion Joint".
 - a. 1/8 inch joint width for exterior work.
- G. Separation Screeds:
 - 1. Install at intersections of two types of plaster, plaster and tile, and where indicated.

3.04 PREPARATION FOR PLASTERING

- A. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair Work.

- B. Surface Conditioning of Concrete and Concrete Unit Masonry Surfaces:
 - 1. Immediately before plastering, dampen concrete and concrete unit masonry surfaces that are indicated for direct plaster application, except where bonding agent has been applied.
 - 2. Determine and apply amount of moisture and degree of saturation that will result in optimum suction for plastering.
 - 3. Bonding Agent:
 - a. Where bonding agent is required, apply to concrete and concrete unit masonry surfaces indicated for direct plaster application.
 - 1) Comply with manufacturer's written instructions for application.

3.05 ACRYLIC MODIFIED FINISH COAT APPLICATION

- A. Two Coat Application:
 - 1. 1/16 inch minimum acrylic finish over 1/16 inch minimum basecoat over cured brown coat.
 - 2. Use primer only when recommended by manufacturer.
 - 3. Do not apply finish when ambient temperature is less than 40 degrees F and has been above 40 degrees for at least 24 hours prior.
 - 4. Do not apply finish materials to Portland cement brown coats when sun is directly on wall surface and temperature is 75 degrees or more.
 - 5. Protect plaster surfaces from precipitation prior to, during application, and through setting/curing period of finish coat.
 - 6. Mix and apply trowelable aggregated acrylic finish system in strict accordance with manufacturer's printed instructions and recommendations of manufacturer's field representative.
 - 7. Apply continuously and in one operation to entire wall area.
 - a. Maintain wet edge.
 - 8. Bring finish minimum distance into sealant joints so that sealant material bonds to substrate but still covers edge of finish.
 - 9. Apply finish so that there are no scaffold lines or other marks due to application.
- B. Application:
 - 1. Apply finish coat following manufacturer's directions, using stainless steel trowel and textured using conventional wood or plastic float to match approved sample.
 - 2. Leave finished base coat surface smooth and even and allowed to air cure for not less than 24 hours.
 - 3. Tolerance:
 - a. Install finished wall surface true, straight, and plumb to 1/8 inch in 10 feet.
 - 4. Allow finish to dry at least 24 hours.
 - a. Protect from weather, soiling, dust, and physical contact until fully dried.
- C. Curing:
 - 1. Cure acrylic finish coat per manufacturer's instructions.

3.06 ACRYLIC MODIFIED FINISH COAT APPLICATION OVER CONCRETE MASONRY

- A. Comply with requirements in Article 3.05.
- B. Apply crack isolation system to concrete masonry surfaces where indicated, in accordance with manufacturer's recommendations and instructions.

- C. Apply acrylic modified finish coat in accordance with requirements in Article 3.07.

3.07 CUTTING AND PATCHING

- A. Cut, patch, point-up and repair plaster as necessary to accommodate other work and to restore cracks dents and imperfections.
1. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry-outs, efflorescence, sweat-outs and similar defects, and where bond to substrate has failed.
 2. Comply with requirements of Section 01 7329.
- B. Sand smooth troweled finishes lightly to remove trowel marks and arises.

3.08 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work.
1. Promptly remove plaster from door frames, windows, and other surfaces which are not to be plastered.
 2. Repair surfaces which have been stained, marred or otherwise damaged during plastering work.
 3. When plastering work is complete, remove unused materials, containers and equipment and clean floors of plaster debris.

END OF SECTION 09 2513

**SHERBECK FIELD IMPROVEMENT PROJECT
FULLERTON COLLEGE
NORTH ORANGE COUNTY COMMUNITY COLLEGE DISTRICT**

SECTION 09 9100

PAINTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Surface preparation, priming, and field painting of following:
 - a. Exposed exterior and interior items and surfaces as indicated.
 - b. Exterior Concrete Stair Treads
- B. Related Sections:
 - 1. Section 05 0513: Shop-Applied Coatings for Metal; shop finishes for extruded aluminum and coil-coated metal
 - 2. Section 05 1200: Structural Steel Framing; shop prep and priming of steel.
 - 3. Section 05 5500: Metal Fabrications; shop prep and priming of galvanized and ferrous metal.
 - 4. Section 05 3000: Metal Decking; painting of underside of metal decking.
 - 5. Section 07 1923: Water Repellent/Graffiti-Resistant Coatings
 - 6. Section 06 4000: Architectural Woodwork; natural wood finish system.
 - 7. Section 07 9200: Joint Sealants
 - 8. Section 08 1113: Hollow Metal Doors and Frames.
 - 9. Section 08 3323: Overhead Coiling Doors; powder coated finish.
 - 10. Section 09 9600: High Performance Coatings; painting of AECS and other exposed metal surfaces, and underside of roof deck.
 - 11. Section 32 1723: Pavement Markings; traffic paint
- C. Related Requirements:
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

1.02 REFERENCES

- A. California Air Resources Board (CARB):
 - 1. South Coast Air Quality Management District (SCAQMD):
 - a. Rule 1113 – Architectural Coatings
 - b. Rule 1168 – Adhesive and Sealant Applications
- B. California Department of Public Health (CDPH):
 - 1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 – 2017
- C. United States Environmental Protection Agency (EPA):
 - 1. 40 CFR Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings
 - a. Method 24 – Surface Coatings
- D. The Society of Protective Coatings (SSPC):
 - 1. SSPC-SP 1 – Solvent Cleaning.

2. SSPC-SP 2 – Hand Tool Cleaning.
3. SSPC-SP 3 – Power Tool Cleaning.
4. SSPC-SP 6 – Commercial Blast Cleaning (NACE No. 3)

1.03 DEFINITIONS

- A. Paint – As used in this Section:
1. Means coating systems materials, including primers, emulsions, enamels, stains, sealers, and other applied materials whether used as prime, intermediate, or finish coats.

1.04 SYSTEM DESCRIPTION

- A. Paint exposed surfaces except where material is obviously intended and specifically noted as surface not to be painted:
1. Where items or surfaces are not specifically mentioned, paint item or surface same as adjacent similar materials or surfaces whether or not schedules indicate colors.
 - a. When system, color, or finish is not designated, Architect will select from standard colors and finishes available.
 2. Refer to Finish Schedules and notations on Drawings.
 3. Painting Includes:
 - a. Exposed steel and iron work not covered in Section 09 9600.
 - b. Conduit, and metal surfaces of electrical equipment as indicated.
 - c. Exposed equipment and other such items as designated or required.
- B. Work Not to be Painted:
1. Do not include painting when factory finishing or installer finishing is specified for such items as, but not limited to, following:
 - a. Aluminum with shop-applied finish.
 - 1) Includes high performance coatings.
 - b. Factory-finished electrical equipment including light fixtures, switchgear and distribution cabinets.
 2. In general, following items will not require finishing unless specifically specified, scheduled, or indicated:
 - a. Flexible conduit connections to equipment, miscellaneous nameplates, stamping, and instruction labels and manufacturer's data.
 - b. Do not paint moving parts of operating units, including, but not limited to:
 - 1) Electrical parts, such as sensing devices.
 - c. Do not paint over code required labels, such as Underwriters' Laboratories and Factory Mutual, or equipment identification, performance rating, name, or nomenclature plates.
 - d. Finish Hardware, except prime coated items.
 - e. Walking Surfaces:
 - 1) Painted concrete curbs and pavement markings are specified in Section 32 1723.
 - f. Concealed Surfaces:
 - 1) Painting is not required on wall or ceiling surfaces in concealed areas and inaccessible areas, such as furred areas, pipe spaces, duct shafts, and elevator shafts, as applicable to Project.
 - g. Exterior concrete and masonry
 3. Portland Cement Plaster:
 - a. Painting of Portland cement plaster:

- 1) Refer to Schedule of Exterior Paint Systems in this Section for appropriate paint system.
- C. Shop Priming:
1. Unless otherwise specified, shop priming of ferrous metal items is included under various sections for metal fabrications, hollow metal work and similar items.

1.05 SUBMITTALS

- A. Product Data:
1. Provide for each paint system specified; include primers.
 2. Material List:
 - a. Provide inclusive list of required coating materials:
 - 1) Indicate each material and cross-reference specific coating, finish system, and application.
 - 2) Identify each material by catalog number and general classification.
 - 3) In addition to manufacturer's name, product name and number, include following:
 - a) Primers, thinners, and coloring agents.
 - b) Manufacturers' catalog data fully describing each material as to content, recommended installation, and preparation methods.
 - b. Identify surfaces to receive various paint materials.
 3. Manufacturer's Information:
 - a. Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
 4. Certification by manufacturer that products supplied comply with local regulations controlling use of Volatile Organic Compounds (VOC).
- B. Samples:
1. After receipt of Architect's Color Schedule, submit following for Architect's review for color and texture only:
 - a. Draw-Downs:
 - 1) Manufacturer-produced draw-downs for each color sample required
 - b. Stepped Samples:
 - 1) Defining each separate coat, including primers.
 - 2) Use representative colors when preparing samples for review.
 - 3) Resubmit until required sheen, color, and texture are achieved.
 2. Furnish list of materials and applications for each coat of each sample.
 - 1) Label each sample for location and application.
 3. Furnish minimum of four 8-1/2 by 11 inch painted samples of each color and material, with texture to simulate actual conditions.
 - a. On Metal – Provide minimum of four 4 by 8 inch samples for each type of finish and color, defining prime and finish coat.
 - b. Do not proceed with painting work until color samples have been accepted.
- C. Field Samples:
1. When and as directed by Architect, apply one complete coating system for each color, gloss and texture required.

2. When approved, sample panel areas will be deemed incorporated into Work and will serve as standards by which subsequent Work of this Section will be judged.
- D. Provide list of solid volume factors for each type of material if so requested by Architect.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project Site in original, new, and unopened packages and containers bearing manufacturer's name and label, and following information:
 1. Name or title of material.
 2. Product Description (Generic Classification or Binder Type).
 3. Federal Specification number, if applicable.
 4. Manufacturer's stock number and date of manufacture.
 5. Manufacturer's name
 6. Contents by volume, for major pigment and vehicle constituents.
 7. Thinning instructions.
 8. Application instructions.
 9. Color name and number.
 10. VOC Content
 11. Concurrently provide local representative of approved paint products with copies of invoices of purchased materials.
- B. Storage and Mixing of Materials:
 1. Store and mix paint materials in single suitable place in compliance with health and fire regulations.
 2. Open and mix ingredients on premises in presence of Project Inspector.
 3. Maintain such storage spaces clean and neat.
 4. Remove oily rags, waste, and like materials from building each night and take every precaution to avoid danger of fire.

1.07 PROJECT CONDITIONS

- A. Apply primers and paints only when temperature of surfaces to be painted and surrounding air temperatures are within range permitted by paint manufacturer's printed instructions.
- B. Do not apply paint in rain, fog, mist or to damp or wet surfaces; or when relative humidity exceeds 85 percent, unless otherwise specified by paint manufacturer.
- C. Do not apply paint, interior, or exterior, when temperature is below 50 degrees F or above 90 degrees F, or when dust conditions are unfavorable for application.
- D. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature ranges specified by paint manufacturer during application and drying periods.
- E. Painting Work by Other Trades:
 1. Examine Drawings and Specifications, including requirements specified in other sections for painting work by other trades.
 2. Notify Architect in writing of conflicts between Work of this Section and that of other trades and sections, and errors, omissions, or impractical requirements.

3. Paint or finish surfaces that are left unfinished by requirements of their specification as Work of this Section.

1.08 REGULATORY REQUIREMENTS

- A. Codes and Standards:
 1. Conform work and materials to regulations of State Fire Marshal, Safety Color Coding in conformance with OSHA, Cal/OSHA, and local or State Ordinances having jurisdiction.
 - a. Conform to most stringent requirements and authorities having jurisdiction.
- B. Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal.
 1. Where those requirements conflict with this Specification, comply with more stringent provisions.
 2. Regulatory changes may affect formulation, availability, or use of specified coatings.
 - a. Confirm availability of coatings to be used prior to Project bid and before start of painting on Project.
 3. Comply with current applicable regulations of following:
 - a. California Air Resources Board (CARB)
 - b. South Coast Air Quality Management District (SCAQMD)
 - c. California Department of Public Health (CDPH)
 - d. U.S. Environmental Protection Agency (EPA), as applicable.

1.09 MAINTENANCE STOCK

- A. Upon completion of Work of this Section, deliver to Owner, extra stock consisting of one gallon of each color, type, and gloss of finish (topcoat) paint used in Work.
 1. Tightly seal each container and clearly label contents and location where used.

PART 2 PRODUCTS

2.01 MATERIAL QUALITY

- A. Provide best quality commercial grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers.
 1. Materials not displaying manufacturer's identification as standard, best grade product will not be acceptable.
- B. Single-Source Responsibility:
 1. Obtain products of only one paint manufacturer unless otherwise specified or approved.
 - a. Obtain primers, thinners, coloring agents, and catalysts for each painting system from same manufacturer as finish coats, or as approved for use by manufacturer of paint, except for materials furnished with shop prime coat by other trades.
 - b. Use approved thinners only within recommended limits.
 - c. Factory mix paint materials to correct color, gloss, and consistency for installation to maximum extent feasible.

- C. Factory mix paint materials to correct color, gloss, and consistency for installation to maximum extent feasible.
- D. Do not use paints in Work which have been packaged longer than six months, except when such products are known to have long package stability when unopened and only when guaranteed by manufacturer.

2.02 MANUFACTURERS

- A. Manufacturer's catalog names and numbers as listed are used to aid in establishing kind and quality of material required and are not used as indication of color desired.
- B. Opaque Paint Finish Materials:
 - 1. Basis-of-Design:
 - a. Paint Systems specified are products of Dunn-Edwards Corporation, Los Angeles, CA, unless indicated otherwise.
- C. Paint Systems as listed are District Standard.
 - 1. Substitutions are not permitted.

2.03 SOURCE QUALITY CONTROL

- A. Obtain paint materials of each paint manufacturer for specified systems, as accepted by Architect.
 - 1. Furnish materials as supplied from paint manufacturer's branded paint store or manufacturer-approved dealer.
 - 2. Furnish copies of invoices from paint supplier to manufacturer's representative and Architect.
 - a. Furnish to Owner when requested.

2.04 COLORS AND FINISHES

- A. Surface treatments and finishes are shown on Drawings and indicated in Schedules on Drawings.
 - 1. Paint colors are shown on Architect's Color Schedule.
- B. Colors required or listed by Architect are not necessarily stock colors available in one particular manufacturer's range.
 - 1. Non-availability of colors selected by Architect will be sufficient reason to disqualify manufacturer not capable of providing such colors.
- C. Paint Coordination:
 - 1. Provide finish coats which are compatible with prime paints used.
 - 2. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates.
 - 3. Upon request from other subcontractors, furnish information on characteristic of specified finish materials, to ensure that compatible prime coats are used.
 - 4. Provide barrier coats over incompatible primers or remove and reprime as required.
 - 5. Notify Architect in writing of anticipated problems using specified coating systems with substrates primed by others.

2.05 PAINTABLE CAULK

- A. Acrylic latex, one-part, non-sag, mildew resistant, non-bleeding and non-staining, acrylic emulsion component compound conforming to ASTM C 834, Type OP, Grade NS, formulated to be paintable.
 - 1. For use as interior caulk in nonworking joints only.
 - 2. Must be able to accommodate joint movement of not more than 5 percent in both extension and compression for total of 10 percent.
 - 3. Backup and Bond Breaker: Products recommended by caulking manufacturer.
 - 4. Provide one of following products:
 - a. AC-20: Pecora Corporation.
 - b. Bostik Home Painter's Caulk: Bostik Construction Products.
 - c. GE RCS20: Momentive Performance Materials.
 - 5. VOC compliant per SCAQMD Rule 1168.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint.
 - 1. Do not begin paint application until unsatisfactory conditions have been corrected and surfaces scheduled to receive paint are thoroughly dry.
- B. Starting of painting will be construed as applicator's acceptance of surfaces and conditions within particular area.

3.02 SURFACE PREPARATION

- A. Clean and prepare surfaces to be painted following paint manufacturer's written instructions and as specified, for each particular substrate condition.
- B. Clean surfaces to be painted before applying paint or surface treatments.
 - 1. Remove oil and grease prior to mechanical cleaning.
 - 2. Program cleaning and painting so contaminants from cleaning process will not fall onto wet, newly painted surfaces.
 - 3. Cover surfaces and equipment as necessary to prevent contaminants from cleaning process from falling onto equipment.
- C. Clean floors and surfaces in room being painted of loose dirt and dust before painting is started.
- D. Moisture Content:
 - 1. Measure moisture content of surfaces using electronic moisture meter.
 - 2. Do not apply finishes unless moisture content of surfaces are below maximum levels specified, or as otherwise recommended by manufacturer.
- E. Remove hardware, hardware accessories, switch and receptacle plates, surface-mounted lighting fixtures, escutcheons and plates, surface-mounted equipment, free-standing equipment blocking access to painted surfaces, and other items as required prior to surface preparation and painting operations.
 - 1. Following completion of painting of each space or area, reinstall removed items.

**SHERBECK FIELD IMPROVEMENT PROJECT
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- F. Provide barrier coats over incompatible primers or remove and reprime.
- G. Ferrous Metals:
 - 1. Clean ungalvanized ferrous metal surfaces that have not been shop coated or are not otherwise specified to receive high performance coatings.
 - 2. Remove oil, grease, dirt, loose mill scale, and other foreign substances.
 - 3. Use solvent (SSPC SP-1) or mechanical cleaning methods (SSPC SP-2 and SP-3) that comply with The Society for Protective Coatings (SSPC) recommendations.
 - 4. Where rust or scale is present, wire brush and sandpaper clean.
 - 5. Clean field welds and abraded portions of field welded and erected ferrous metal components.
- H. Galvanized Surfaces:
 - 1. When indicated to be painted, clean galvanized surfaces with non-petroleum-based solvents complying with SSPC SP-1, so surface is free of oil and surface contaminants.
 - a. When necessary, brush blast surfaces complying with SSPC SP-7 to remove burrs and rough spots.
 - 2. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
 - 3. Spot prime field connections, welds, soldered joints, and burned and abraded portions.
 - 4. Sand or etch factory finished surfaces indicated to be repainted to increase adherence of finish coats.
- I. Paintable Caulk Installation:
 - 1. Comply with general sealant installation requirements in Section 09 9200.
 - 2. Use only for caulking of followings joints in dry areas:
 - a. Perimeter caulking of:
 - 1) Interior door frames.
 - 2) Casework not subject to moisture.
 - 3. Joint Design:
 - a. Width of joint should be approximately 12 times anticipated movement and fall within range of 1/4 inch to 3/4 inch

3.03 MATERIAL PREPARATION

- A. Mix and prepare painting materials in field following manufacturer's directions.
- B. Store materials not in actual use in tightly covered containers.
 - 1. Maintain containers used in storage, mixing and application of paint in clean condition, free of foreign materials and residue.
- C. Stir materials before application to produce mixture of uniform density:
 - 1. Stir as required during application.
 - 2. Do not stir surface film into material.
 - 3. Remove film and, if necessary, strain material before using.

3.04 APPLICATION

- A. Apply paint following manufacturer's directions.
 - 1. Use applicators and techniques best suited for substrate and type of material being applied.
 - 2. Mix to proper consistency.
 - 3. On brush-applied work, brush out smooth leaving minimum of brush marks, with paint uniformly flowed on.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, and conditions otherwise detrimental to formation of durable paint film.
- C. Apply paint to clean, dry, prepared surfaces only.
 - 1. Apply paint material evenly, smoothly flowed on without runs, sags, or holidays.
- D. Provide finish coats compatible with primers used.
- E. Minimum Coating Thickness:
 - 1. Apply each material at not less than manufacturer's recommended spreading rate, to provide a total dry film thickness of not less than 5.0 mils for entire coating system of prime and finish coats for 3 coat work.
 - 2. Provide total dry film thickness of not less than 3.5 mils for entire coating system of prime and finish coat for 2 coat work.
- F. Number of coats and film thickness required is same regardless of application method.
 - 1. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 - 2. Sand between applications where sanding is required to produce even smooth surface following manufacturer's directions.
- G. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance.
 - 1. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive dry film thickness equivalent to that of flat surfaces.
 - 2. Number of coats specified herein are minimum to be applied.
 - a. Apply additional coats in event full coverage is not obtained or required total thickness of paint does not comply with mil thickness recommended by paint manufacturer.
- H. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
- I. Included Work:
 - 1. Finish tops, bottoms, and edges of doors same as balance of door.
 - 2. Where walls are specified to be painted, include columns, arrises, reveals, soffits, returns, and like surfaces.
- J. Priming:
 - 1. Where shop coats and touch-up painting are specified under other sections of Work, omit prime coat.

- K. Completed Work:
 - 1. Match approved samples for color, texture, and coverage.
 - 2. Remove, refinish, or repaint work not in compliance with specified requirements.

3.05 CLEANING AND PROTECTION

- A. Cleaning:
 - 1. At end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from Project Site.
 - 2. Remove paint, varnish and brush marks from glazing material
 - 3. Upon completion of painting work, wash and polish glazing material both sides.
 - a. Remove and replace glazing material, which has been damaged by painting operations, with new material.
 - 4. Comply with additional cleaning requirements specified in Section 01 7423.
- B. Protection:
 - 1. Protect work of other trades, whether to be painted or not, against damage by painting.
 - 2. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- C. Protect floors and adjacent surfaces from paint smears, spatters, and droppings:
 - 1. Use dropcloths to protect floors.
 - 2. Cover fixtures and mask off areas where required.
- D. Provide "Wet Paint" signs and barricades to protect newly painted finishes.
 - 1. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
- E. At completion of work of other trades, touch-up and restore damaged and defaced painted surfaces.

3.06 PAINT SYSTEM SCHEDULES – GENERAL

- A. Provide following paint systems for substrate indicated.
 - 1. Products must meet or exceed current applicable regulations of agencies listed in Regulatory Requirements Article.

3.07 SCHEDULE OF EXTERIOR PAINT SYSTEMS

- A. **Paint System Type 2:**
 - 1. Type and Gloss: 100 percent Acrylic, Eggshell
 - 2. Use: Portland Cement Plaster
 - a. Primer (1st Coat):
 - 1) SLPR00-2-WH SUPER-LOC Premium
 - b. 2nd and 3rd Coats:
 - 1) EVSH30-3 EVERSIELD Exterior Eggshell

B. Paint System Type 8:

1. Type and Gloss: Water-based Acrylic Urethane, Semi-Gloss
2. Use: Exterior Hollow Metal Doors and Frames.
 - a. Primer:
 - 1) UGPR00 ULTRA-GRIP Interior/Exterior, *or*
 - 2) BRPR00 Block Rust Premium, *or*
 - 3) ENPR00 ENDURAPRIME Metal Primer
 - b. 2nd and 3rd Coats:
 - 1) ASHL50 ARISTOSHIELD Semi-Gloss Interior/Exterior

C. Paint System Type 13:

1. Type and Gloss: Aliphatic Urethane; Semi-Gloss
2. Use: Exterior Ferrous Metal Sheet Metal Flashing and Trim (except where specified to be prefinished), steel bollards.
 - a. Primer (1st Coat):
 - 1) Epoxy Mastic:
 - a) Carboline Carbomastic 15
 - b. 2nd and 3rd Coats:
 - 1) Aliphatic Acrylic-Polyester Polyurethane:
 - a) Carboline Carbothane 133 MC

3.08 SCHEDULE OF INTERIOR PAINT SYSTEMS

A. Paint System Type 24:

1. Type and Gloss: Semi-Gloss
2. Use: hollow metal doors and frames.
 - a. Primer (1st Coat):
 - 1) UGPR00-1 ULTRA-GRIP Premium, Multi Purpose Primer, *or*
 - 2) ASHL50 ARISTOSHIELD Semi-Gloss Interior/Exterior
 - b. 2nd and 3rd Coats:
 - 1) ASHL50 ARISTOSHIELD Semi-Gloss Interior/Exterior Ultra-Low VOC

3.09 SPECIAL TREATMENT OF SPECIFIC SURFACES

A. Paint System Type 39:

1. Type and Gloss: Waterborne, Acrylic, Flat.
2. Use: Exterior Concrete Stair Treads
 - a. One Coat:
 - 1) VSZM10-1 VIN-L-STRiPE Interior/Exterior Zone Marking Paint
3. Allow concrete to cure as required by paint manufacture before applying paint.
4. Cleaning: Sweep and clean surface to eliminate loose material and dust.
5. Apply paint with mechanical equipment to produce uniform straight edges.
 - a. Use painting equipment and masking specifically designed for this purpose.
 - b. Protect adjoining surfaces from overspray or damage
6. Color: Black

B. Paint System Type 42:

1. Miscellaneous Mechanical and Electrical Work:
 - a. Paint exposed surfaces of mechanical and electrical Work not otherwise specified, including but not limited to following:
 - 1) Interior plumbing, HVAC, and electrical, factory-primed equipment, apparatus, pipes and fittings.
 - 2) Vents, ducts, miscellaneous supports and hangers.
 - 3) Electrical conduit, fittings, pull boxes, outlet boxes, and other unfinished surfaces of mechanical and electrical Work.
 - 4) Miscellaneous factory-primed metal cabinets, and panels.
2. Provide paint systems for each type of material in accordance with paint manufacturer's recommendations, unless otherwise indicated.
 - a. Make submittals of each system for Architect's review, in accordance with requirements of this Section and Section 01 3300.
3. Colors: As scheduled.

END OF SECTION 09 9100

SECTION 09 9600

HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Preparation, priming, and application of high performance field applied coatings, including but not necessarily limited to, following:
 - a. Exposed structural steel and related steel components
 - b. Exposed underside of metal decking.
 - c. Chain link fences and gate that are unable to receive vinyl coating.
 - d. Decorative metal fence and gates.
- B. Related Sections:
 - 1. Section 05 0513: Metal Finishes; factory applied high performance finishes on aluminum and coil-coated steel.
 - 2. Section 05 1200: Structural Steel Framing; shop cleaning and priming of structural steel specified to receive high performance coatings
 - 3. Section 05 3000: Metal Decking
 - 4. Section 05 5000: Metal Fabrications; shop cleaning and priming of miscellaneous metal specified to receive high performance coatings
 - 5. Section 09 9100: Painting; ferrous metal not specified to be galvanized, or to receive high performance coating.

1.02 REFERENCES

- A. National Association of Architectural Metal Manufacturers (NAAMM):
 - 1. AMP 500 – Metal Finishes Manual
- B. The Society for Protective Coatings (SSPC):
 - 1. SSPC SP 1 – Solvent Cleaning.
 - 2. SSPC SP 2 – Hand Tool Cleaning.
 - 3. SSPC SP 3 – Power Tool Cleaning.
 - 4. SSPC SP 6 – Commercial Blast Cleaning.
- C. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1113 – Architectural Coatings

1.03 SUBMITTALS

- A. Product Data:
 - 1. For each coating system specified; including primers.
 - 2. Material List:
 - a. Provide inclusive list of required coating materials.
 - 1) Indicate each material and cross-reference specific coating, finish system, and application.

- 2) Identify each material by manufacturer's catalog number and coating material proposed for use.
 3. Manufacturer's Information:
 - a. Provide manufacturer's technical information, including instructions for handling, storing and applying each coating material proposed for use.
 4. Certification by manufacturer that products supplied comply with local regulations controlling use of Volatile Organic Compounds (VOC).
- B. Samples:
1. Applied finishes on steel, for color and finish.
 2. Provide minimum 4 by 8 inch pieces, and 8 inch lengths of larger sizes as required to show finished work.
- C. Qualification Data:
1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience.
 2. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications:
1. Engage experienced applicator who has completed high performance coating system applications similar in material and extent to that indicated for this Project with record of successful in-service performance.
- B. Coating manufacturer's technical representative will perform following:
1. Conduct periodic inspections of surface preparation and coating operations in shop and field, as required to obtain specified warranty.
 2. Coating contractor is responsible for contacting coating manufacturer's technical representative to arrange for required inspections.
 3. Notify Architect when Contractor fails to meet any portion of specification.

1.05 WARRANTIES

- A. Special Finish Warranty:
1. Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period.
 2. Warranty does not include normal weathering.
 3. Warranty Period:
 - a. 10 years from date of Substantial Completion for Type A coating
 - b. 5 years from date of Substantial Completion for Type B coating system.
- B. Jointly warrant completed high performance coatings by respective coating manufacturer and coating applicator to meet weathering tests and performance requirements as specified.
1. Coating applicator must apply for coating warranty at time of application.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Products:
 - 1. High Performance Coatings on steel are based on following systems as manufactured by The Carboline Company:
 - a. Type B: Organic Zinc-Rich Epoxy/Waterborne Acrylic Polyurethane System.
 - b. Type D: Waterborne Acrylic System.
- B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 1600 and following:
 - 1. Submit items listed under Submittals and as specified in Section 01 3300, for evaluation of proposed system.
 - 2. Document that tests have been made for identical systems within ranges of specified performance standards and criteria for application to specified substrates.
 - 3. Acceptance is also subject to availability of acceptable color matching specified color.
 - 4. Copy of manufacturer's minimum 10 year finish and material warranty.

2.02 COATING MATERIALS – GENERAL

- A. Material Compatibility:
 - 1. Provide primers and finish coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality:
 - 1. Provide manufacturer's highest grade of various high performance coatings specified; of uniform color throughout and color-fast.
 - 2. Materials not displaying manufacturer's product identification are not acceptable.
- C. Coating manufacturers and coating applicators are required to develop jointly methods and procedures for surface preparation, priming, and finish coating of materials.

2.03 HIGH-PERFORMANCE FIELD APPLIED COATING SYSTEMS

- A. High Performance Coating System Type B:
 - 1. High performance pigmented two component shop applied system consisting of organic zinc-rich epoxy primer and aliphatic acrylic polyurethane finish coat, as manufactured by Carboline Company, which meets or exceeds following performance provisions:
 - a. Resistant to abrasion, corrosion, and chemical exposure.
 - b. Repel surface dirt and contaminants.
 - 2. Provide two coat system consisting of:
 - a. Primer Coat: Carbozinc 859 VOC Organic Zinc-Rich Epoxy Primer at 3.0 to 5.0 mils dry film thickness.
 - 1) VOC Value: 95 g/l, as supplied/unthinned.

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- b. Finish Coat: Carbothane 133 MC Aliphatic Acrylic-Polyester Polyurethane at 3.0 to 5.0 mils dry film thickness
 - 1) VOC Value: 97 g/l, as supplied/unthinned.
 - 2) Color: As selected by Architect.
 - 3. Apply Coating System Type B to:
 - a. Structural steel and related steel components exposed to view at completion of Work.
 - b. New decorative metal fence, including posts, pickets, and gates.
- B. High Performance Coating System Type D:
 - 1. High performance pigmented two component field applied system consisting of waterborne acrylic primer and waterborne acrylic finish coat, as manufactured by Carboline Company, which meets or exceeds following performance provisions:
 - a. Resistant to abrasion, corrosion, and chemical exposure.
 - b. Repel surface dirt and contaminates.
 - 2. Provide two coat system consisting of:
 - a. Primer Coat: Galoseal Waterborne Acrylic Primer at 0.5 to 1.0 mils dry film thickness.
 - 1) VOC Value: 99 g/l, as supplied/unthinned.
 - b. Finish Coat: Carbocrylic 3359 MC Waterborne Acrylic at 2.0 to 3.0 mils dry film thickness
 - 1) VOC Value: 60 g/l, as supplied/unthinned.
 - 2) Color: As selected by Architect.
 - 3. Apply Coating System Type D to:
 - a. Exposed underside of exterior and interior metal decking.

2.04 SOURCE QUALITY CONTROL

- A. Source Limitations:
 - 1. Obtain primers for each coating system from same manufacturer as finish coats.

2.05 PERFORMANCE REQUIREMENTS

- A. Provide coating systems suitable for shop and field application to steel.
- B. Conform to applicable performance standards of following where referenced in specification:
 - 1. National Association of Architectural Metal Manufacturers (NAAMM): "Metal Finishes Manual"
 - 2. ASTM International (ASTM).
 - 3. The Society for Protective Coatings (SSPC).

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Surfaces to receive high performance coating must be free of grinding marks and weld splatter.
 - 1. Grind welds smooth.

- B. Finish visible surfaces of exposed Work.
 - 1. Visible surfaces are defined as surfaces which will be exposed to view from exterior and in interior of completed building.
- C. Perform finishing after fabrication, forming, fitting, and welding have been completed.
- D. Finishes on Exposed Work:
 - 1. Be uniform in appearance
 - 2. Members are to match each other exactly throughout installed Work.
- E. Specified finishes establish type and quality required.
 - 1. Applied finishes are subject to Architect's acceptance.

3.02 SHOP CLEANING AND PRIMING OF EXPOSED STEEL

- A. Exposed Structural Steel Not Occurring In Corrosive Areas:
 - 1. Comply with requirements of Sections 05 1200, 05 5000, and following:
 - a. Clean surfaces just prior to painting in accordance with SSPC-SP1 – Solvent Cleaning to remove dirt and contaminants, followed by dry-blast cleaning in accordance with SSPC-SP 6 – Commercial Blast Cleaning.
 - 2. Fill small pit marks in otherwise smooth, sound surfaces with metallic compound, finish flush and smooth.
 - 3. Apply one coat of specified zinc-rich primer after fabrication and cleaning.
 - a. Apply two coats to surfaces that will be inaccessible after fabrication or after installation.
- B. Exposed Structural Steel and Hollow Metal Doors and Frames Occurring In Corrosive Areas:
 - 1. Comply with requirements of Sections 05 1200, 05 5000, 08 1113, and following:
 - a. Clean surfaces just prior to painting in accordance with SSPC-SP 1 – Solvent Cleaning to remove dirt and contaminants, followed by dry-blast cleaning in accordance with SSPC-SP 6 – Commercial Blast Cleaning.
 - b. Fill small pit marks in otherwise smooth, sound surfaces with metallic compound, finish flush and smooth.
 - c. Apply one coat of polymeric epoxy amine primer specified in Article 2.03, after fabrication and cleaning.
 - 1) Apply two coats to surfaces that will be inaccessible after fabrication or after installation.

3.03 FIELD CLEANING AND PAINTING OF EXPOSED STEEL

- A. Surfaces to receive high performance coating must be free of grinding marks and weld splatter.
 - 1. Welds are to be ground smooth.
- B. Clean surfaces in accordance with SSPC-SP 2 or SP 3 as required and touch up primer as necessary.
- C. Field apply one coat of Type A high performance finish specified, to Architecturally Exposed Structural Steel (AESS) and other steel components indicated, in accordance with coating manufacturer's recommendations and instructions.

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- D. Field apply one coat of Type B high performance finish specified, to exposed surfaces of interior and exterior stair support framing, and exterior steel handrails and guardrails, in accordance with coating manufacturer's recommendations and instructions.

3.04 CLEANING

- A. Comply with Section 01 7423 and following:
 - 1. Clean in accordance with coating manufacturer's recommendations.
 - 2. Do not use materials or methods which may damage finishes or surrounding construction.

3.05 PROTECTION

- A. Protect finished surfaces from damage until acceptance by Owner.

END OF SECTION 09 9600

SECTION 10 1400

SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Furnishing materials, labor, and equipment necessary for completion of signage as indicated on Drawings and as specified.
 - 2. Types of signage include, but is not necessarily limited to following:
 - a. Exterior plastic sign.
 - 3. Engaging independent Braille reading consultant.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 32 1723: Pavement Markings; accessible parking striping
- C. Related Requirements:
 - 1. Refer to Division 26 Sections for illuminated exit signs.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
 - 1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

1.03 DEFINITIONS

- A. Characters:
 - 1. Letters, numbers, punctuation marks, and typographic symbols.
- B. Facility:
 - 1. Portions of buildings, structures, equipment, walks, passageways, or other real or property located on Project Site.
- C. Sign:
 - 1. Architectural element composed of displayed text, symbolic, tactile or pictorial information.
- D. Space:
 - 1. Definable area, such as room, toilet room, hall, entrance, storage room, or lobby.
- E. Tactile:
 - 1. Object that can be perceived through sense of touch.

1.04 SYSTEM DESCRIPTION

- A. Comply with most stringent requirements of CBC, current edition, Chapter 11B for following:
 - 1. Tactile character type and size.
 - 2. Finish and contrast.
 - 3. Raised and visual characters.
 - 4. Visual character and line spacing height and installation height.
 - 5. Braille:
 - a. Use California (Contracted) Grade 2 Braille wherever Braille is required.
 - 6. Tactile sign installation height and location.

1.05 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's technical data and installation instructions for each type of sign required.
- B. Samples:
 - 1. Each sign form and material showing finishes, colors, surface textures and qualities of manufacturer and design of each sign component including graphics.
 - a. Full-size sample units, when requested by Architect.
 - b. Acceptable units may be installed as part of Work.
- C. Shop Drawings:
 - 1. For fabrication and erection of signs.
 - a. Include plans, elevations, and large scale details of sign wording and lettering layout.
 - b. Show anchorages and accessory items.
 - c. Furnish location template drawings for items supported or anchored to permanent construction.
 - d. Furnish full-size spacing templates for individually mounted letters.

1.06 QUALITY ASSURANCE

- A. Uniformity of Manufacturer:
 - 1. For each separate type of sign required, obtain signs from one source from single manufacturer.
- B. Accessibility:
 - 1. Comply with CBC, Chapter 11B.
 - 2. Provide tactile exit signage complying with CBC Section 1013.4.
- C. Independent Braille Reading Consultant:
 - 1. Engage independent Braille reading consultant to read and confirm that Braille on signage matches words on signs.
 - 2. Fabricate signs prior to Braille reading consultant reading signs.
 - a. Physical fingertip to sign verification is required.
 - b. Exceptions to this requirement are not permitted and will not be approved.
 - 3. When signs have been fabricated, they are to be sent to Braille reading consultant for verification and confirmation of compliance.

- a. Signs not in compliance are to be brought to attention of District and Architect prior to refabrication.
- b. Upon completion of review of non-compliant signs by District and Architect, those signs are to be refabricated at no additional cost to the District.
- c. A final review of newly fabricated signs are to be verified and confirmed in compliance by the Braille reading consultant prior to installation.
4. The Contractor is to provide a letter from the Braille reading consultant to the District and Architect that the review of all Braille signage has been performed per the requirements set in the specifications.
5. Braille Reading Consultant:
 - a. Following agency has been approved by District:
 - 1) Wayfinder Family Services, 5300 Angeles Vista Blvd., Los Angeles, CA 90043.
 - 2) Contact:
 - a) Allison Burdett, 323-295-4555, aburdett@wayfinderfamily.org
 - b. Other Braille reading consultants may be used but will require prior approval by Architect before award of Contract.
 - 1) No consultants will be approved after award of Contract.

PART 2 PRODUCTS

2.01 GENERAL

- A. Letter Style: Helvetica Medium, unless indicated otherwise..
 1. Uppercase Letters.

2.02 PLASTIC SIGNS

- A. Basis-of-Design:
 1. Design for interior plastic room signs is based on Best Sign Systems standard HC 300 ADA System plaque signs and accessories as manufactured by Best Manufacturing Co., Montrose, CO.
- B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
 1. Submit items listed in "Submittals" Article and as specified in Section 01 3300, for evaluation of proposed system.
 2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
 3. Copy of manufacturer's finish and material warranty.
- C. Material:
 1. Plaque stock of laminated phenolic and melamine plastic (MP) for interior signs and fiberglass (FP) for exterior signs suited for graphic sandblast process.
 2. Sign stock with face and core plies suited for integral raised profile of text and braille, in finishes and color combinations indicated or, when not indicated, as selected from manufacturer's standards.
 3. NEMA rated self-extinguishing.
 4. Thickness: 1/4 inch.
 5. Edges: Square cut.

6. Corners: As indicated on Drawings.
- D. Finish and Contrast:
 1. Matte finish with color of characters and symbols contrasting with background by minimum of 70 percent, and have non-glare finish per CBC Sections 11B-703.5.1, 11B-703.6.2, and 11B-703.7.1
 2. Colors as selected by Architect.
- E. Raised (Tactile) and Visual Characters:
 1. Provide raised characters minimum of 5/8 inch and maximum of 2 inches high, based on height of uppercase letter "I", complying with CBC Sections 11B-703.2 and 11B-703.2.5
 - a. Accompanied by California Contracted Grade 2 Braille complying with CBC Section 11B-703.2.
 2. Proportions:
 - a. Select Characters from fonts where width of uppercase letter "O" is 60 percent minimum and 110 percent maximum of height of uppercase letter "I" per CBC Sections 11 B-703.4 and 11 B-703.6
 3. Format:
 - a. Horizontal Text Format per CBC Sections 11 B-703.2 and 11 B-703.5
 4. Stroke Thickness:
 - a. Stroke thickness of uppercase letter "I" – 15 percent maximum of height of character per CBC Section 11 B-703.4 and 11B-703.6
 5. Raised Character and Line Spacing:
 - a. Measure character spacing between two closest points of adjacent raised characters within message, excluding word spaces.
 - b. Where characters have rectangular cross sections, make spacing between individual raised characters 1/8 inch minimum and 4 times raised character stroke width maximum.
 - c. Where characters have other cross sections, make spacing between individual raised characters 1/16 inch minimum and 4 times raised character stroke width maximum at base of cross sections, and 1/8 inch minimum and 4 times raised character stroke width maximum at top of cross sections.
 - d. Separate Characters from raised borders and decorative elements 3/8 inch minimum.
 - e. Make spacing between baselines of separate lines of raised message at 135 percent minimum and 170 percent maximum of raised character height per CBC Section 11 B-703.2
 6. Visual Character and Line Spacing:
 - a. Measure visual character spacing on between two closest points of adjacent characters, excluding word spaces.
 - b. Make spacing between individual characters at 10 percent minimum and 35 percent maximum of character height.
 - c. Make spacing between the baselines of separate lines of characters within message at 135 percent minimum and 170 percent maximum of character height per CBC Section 11B-703.5
 7. Visual Character Height and Installation Height:
 - a. Minimum character height complying with CBC Table 11 B-703.5.5
 8. Measure viewing distance as horizontal distance between character and obstruction preventing further approach towards sign.
 9. Base character height on uppercase letter "I".

- a. Install visual characters at 40 inches minimum above finish floor or ground.
- 10. Visual Character Case and Style:
 - a. Visual Characters on Sign:
 - 1) Uppercase or lowercase or combination of both and conventional in form.
 - b. Characters:
 - 1) Not to be italic, oblique, script, highly decorative, or of other unusual forms per CBC Section 11 B-703.5
- 11. Visual Character Stroke Thickness:
 - a. Stroke thickness of uppercase letter "I": 10 percent maximum of height of character per CBC Section 11 B-703.5
- F. Braille:
 - 1. Use California (Contracted) Grade 2 Braille wherever Braille is required, complying with CBC Sections 11B-703.3 and 11B-703.4
 - 2. Braille Dots:
 - a. Locate 0.100 inch on center in each cell with 0.300 inch space between cells, measured from second column of dots in first cell to first column of dots in second cell.
 - b. Raised minimum of 0.025 inch above background.
 - c. Domed or rounded per CBC Sections 11B-703.3 and 11B-703.3.1
 - 3. Position Braille below corresponding text in horizontal format, flush left or centered.
 - 4. Place Multi-lined text, Braille below entire text.
 - 5. Separate Braille 3/8 inch minimum and 1/2 inch maximum from other tactile characters, and 3/8 inch minimum from raised borders and decorative elements. per CBC Section 11 B-703. 3
- G. Applied copy not acceptable.
- H. Provide Plastic Signs as indicated in schedule and details.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General – Locate sign units and accessories where shown, scheduled, or directed by Architect.
 - 1. Use mounting methods shown or selected by Architect.
 - 2. Comply with manufacturer's instructions, and CCR, Title 24, Part 2, CBC Chapter 11 B.
- B. Install level, plumb, and at proper height with sign surfaces free from distortion or other defects in appearance.
 - 1. Cooperate with other trades for installation to finish surfaces.
 - 2. Repair or replace damaged units as directed by Architect.
- C. Tactile Sign Installation Height and Location:
 - 1. Locate tactile characters on signs minimum of 48 inches above finish floor or ground surface, measured from baseline of lowest Braille cells and 60 inches maximum above finish floor or ground surface, measured from baseline of highest line of raised characters.

2. Locate tactile signs on approach side of door at entry or exit, and allow for reach within 0 inches of required clear floor space per CBC Section 11B-703.4.2.
 - a. Where tactile sign is provided at door, locate sign on wall alongside door at latch side.
 - b. Locate signs containing tactile characters so that clear floor space of 18 inches minimum by 18 inches minimum, centered on tactile characters, is provided beyond arc of door swing between closed position and 45 degree open position per CBC Section 11 B-703.4
- D. Plastic Signs:
 1. Mount sign with aluminum T-type bracket:
 - a. Provide for concealed mechanical fastening to wall.
 - b. Finish to match adjacent surface
 2. Locate signs so that person may approach within 3 inches of sign without encountering protruding objects or standing within swing of door per CBC Chapter 11B.

3.02 CLEANING AND PROTECTION

- A. At completion of installation, clean soiled sign surfaces in accordance with manufacturer's instructions.
 1. Protect units from damage until acceptance by Owner.

END OF SECTION 10 1400

SECTION 10 4400

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fire extinguishers.
 - 2. Fire extinguisher cabinets.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.

1.02 REFERENCES

- A. California Code of Regulations:
 - 1. Title 19 – Public Safety
 - 2. Title 24, current edition:
 - a. Part 2 - California Building Code (CBC), Volumes 1 and 2.
 - b. Part 9 – California Fire Code (CFC).
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 10 – Standard for Portable Fire Extinguishers.

1.03 QUALITY ASSURANCE

- A. Provide portable fire extinguishers, cabinets and accessories by one manufacturer, unless otherwise acceptable to Architect.
- B. UL-Listed Products:
 - 1. Provide new portable fire extinguishers which are UL Listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.
- C. Provide fire extinguishers as required by CCR, Title 19 and NFPA 10.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's technical data and installation instructions for portable fire extinguishers required.
 - 2. Include roughing-in dimensions, and details for fire extinguisher cabinets:
 - a. Show mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, style and materials.
 - 3. Where color selection by Architect is required, include color charts showing full range of manufacturer's standard colors and designs available.
- B. Samples:
 - 1. Minimum of four, 6 inch square, of each required finish.
 - 2. Prepare samples on metal of same gage as metal to be used in Work.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with specified requirements, provide products of one of following:
 - 1. JL Industries.
 - 2. Larsen's Mfg. Co. (Basis-of-Design)
 - 3. Potter-Roemer Inc.
 - 4. Standard Fire-West

2.02 FIRE EXTINGUISHERS (FE)

- A. General:
 - 1. Provide fire extinguishers for each extinguisher cabinet and other locations indicated:
 - a. In colors and finishes selected by Architect from manufacturer's standard.
 - b. Complying with requirements of governing authorities.
- B. Multi-Purpose Dry Chemical Type:
 - 1. UL-rated 4-A:80:B:C
 - a. 10 lb. nominal capacity, in enameled steel container,
 - 1) Class A, Class B and Class C fires.
 - b. Model MP-10 by Larsen's Mfg. Co.

2.03 FIRE EXTINGUISHER CABINETS (FEC)

- A. General:
 - 1. Provide fire extinguisher cabinets where indicated,
 - a. Suitable size for housing fire extinguishers of types and capacities indicated.
 - 2. Comply with CBC Chapters 11B-205 and 11B-403.5.1
- B. Construction:
 - 1. Manufacturer's standard enameled steel box.
 - 2. Provide trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 3. Weld joints and grind smooth.
 - 4. Miter and weld perimeter door frames.
- C. Cabinet Type:
 - 1. Suitable for mounting conditions indicated, of following types:
 - 2. Surface:
 - a. Cabinet box (tub) surface mounted on walls where indicated.
- D. Trim Style:
 - 1. Fabricate trim in one piece with corners mitered, welded and ground smooth.
 - 2. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Door Material and Construction:
 - 1. Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

- 2. Steel:
 - a. Manufacturer's standard steel door construction.
- F. Door Style:
 - 1. Manufacturer's standard design as specified.
 - a. Solid Door with Vertical Die-Cut Letters.
- G. Door Hardware:
 - 1. Provide manufacturer's standard door operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 2. Provide surface mounted door pull with Larsen-Loc Door Locking System.
 - 3. Provide concealed or continuous type hinge permitting door to open 180 degrees.
- H. Basis-of-Design:
 - 1. Architectural Series:
 - a. Model as listed, by Larsen's Mfg. Co.:
 - 1) Model No. 2409-SM.

2.04 FACTORY FINISHING OF FIRE EXTINGUISHER CABINETS

- A. General:
 - 1. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations except as otherwise indicated.
 - 2. Apply finishes in factory after products are assembled.
 - 3. Protect cabinets with plastic or paper covering, prior to shipment.
- B. Painted Finish for Box:
 - 1. Preparation:
 - a. Clean surfaces of dirt, grease, and loose rust or mill scale.
 - b. Apply finish to surfaces of fabricated and assembled units, whether exposed or concealed when installed, except those surfaces specified to receive another finish.
 - 2. Baked Enamel Finish:
 - a. Immediately after cleaning and pretreatment, apply manufacturer's standard baked enamel coating.
 - b. Provide manufacturer's standard white color.
- C. Steel Finish for Doors and Trim:
 - 1. Baked Enamel Finish.
 - a. Provide manufacturer's standard red color.
 - 2. Furnish with paper masking to protect finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire extinguishers and cabinets.
 - 1. Install each cabinet plumb and level, and secure rigidly in place
- B. Locate fire extinguisher cabinets where indicated, and along accessible route complying with CBC Section 11B-403.
- C. Locate height of fire extinguisher handle and fire extinguisher cabinet opening hardware to comply with reach ranges in CBC Section 11B-308 and following:
 - 1. Maximum 48 inches above finished floor per CBC Sections 11B-308.2 and 11B-308-3.
 - 2. Opening Hardware:
 - a. Accessible with U-shaped pull and latch force less than 5 pounds, per CBC Section 11B-309.4

3.03 IDENTIFICATION

- A. Identify fire extinguisher in cabinet with vertical die-cut lettering spelling "**FIRE EXTINGUISHER**".
 - 1. Provide lettering on door as indicated.
 - 2. Letter Color: White

END OF SECTION 10 4400

SECTION 10 5613

METAL STORAGE SHELVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Standard Boltless Storage Shelving
 - a. Provide with wood shelves.
- B. Related Sections:
 - 1. Section 06 1053: Miscellaneous Carpentry; MDF board for shelves.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, 2019 edition.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's printed data including materials, accessories, construction, finishes, assembly, and installation instructions.
- B. Shop Drawings:
 - 1. Indicate method of attachment to floor and structural bracing for lateral loads for freestanding shelving units.
- C. Samples:
 - 1. Minimum four 3 inch by 5 inch color chips on same metal to be used for fabrication of shelving.
 - 2. Minimum of four 6 inch by 6 inch samples of MDF material used for shelves in specified thickness.

PART 2 PRODUCTS

2.01 MANUFACTURER AND TYPE

- A. Subject to compliance with specified requirements, provide products by one of following:
 - 1. Lyon Metal Products
 - 2. Penco Products (Basis-of-Design - RivetRite)
 - 3. Republic Storage Products
- B. Type: Boltless.

2.02 MATERIALS

- A. Metal Storage Shelving:
 - 1. Double Rivet Bulky Storage Units:
 - a. Unit Dimensions: 48 inches wide by 84 inches high.

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2. Shelves:
 - a. Shelf Depth:
 - 1) 24 inches deep.
 - 2) 12 inches deep.
 - b. Provide 4 shelves per unit.
 3. Locations of storage shelving units are indicated on Drawings
- B. Components:
1. Posts:
 - a. Heavy Duty Angle Post:
 - 1) 1-7/8 inches x 1-7/8 inches
 - b. Heavy Duty Tee Post:
 - 1) 3-3/4 inches x 1-7/8 inches
 - c. Shelf Beams:
 - 1) Double Rivet Shelf Beam
 - a) Solid beams with 2 lugs on each end.
 - b) Adjustable on 1-1/2 inch centers
- C. Accessories for Storage Shelving:
1. Provide accessories, including but not necessarily limited to following:
 - a. Label holders for shelves
 - b. Seismic floor anchors
 - c. Include necessary sway bracing for open back units.
 - d. Provide continuous label holders on shelving.
 - e. Other incidental items as required for complete installation
- D. Baked-Enamel Finish:
1. Immediately after cleaning and pre-treating, apply manufacturer's standard baked enamel finish consisting of thermosetting topcoat.
 - a. Comply with paint manufacturer's instructions for application and baking to achieve dry film thickness of not less than 1.5 mils.
 2. Color:
 - a. Manufacturer's 028 Gray
- E. Wood Shelves:
1. Medium Density Fiberboard (MDF) as specified in Section 06 4000.
 - a. Furnish wood shelves for each shelf unit.
 - b. Thickness: 3/4 inch

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions and following:
1. Provide structural bracing of shelving for lateral loads in accordance with approved shop drawings.
- B. Anchor each shelving unit to floor with approved fasteners through seismic floor anchors furnished by shelving manufacturer.
1. Provide additional anchors or bracing as may be required by authorities having jurisdiction.

END OF SECTION 10 5613

SECTION 26 5000
LIGHTING FIXTURES

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included:
All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
 2. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. General
1. Submit Certification Letter from Manufacturers of Lamps and power supplies, (or alternately, Manufacturer's published catalog data) stating/showing the specific lamp, ballast, or power supply combinations comply with Manufacturer recommendation and approval for the combined use, shown on the Drawings.
 2. Provide complete Manufacturers catalog data information for each light fixture (luminaire), driver, lamp, materials, auxiliary equipment/devices, finishes and photo-metrics.
- B. Performance Certification
1. Submit Manufacturer's Test Report Data showing compliance with Contract Document.
 2. Submit Manufacturer's Letter of Certification for each fixture type, confirming the proposed combination of specific lamp, ballast and auxiliary components for each light fixture (luminaire) type will function together correctly and perform in compliance with the Requirements of the Contract Documents as follows:
"The proposed lamp(s), lamp ballast(s) (where, applicable), lamp sockets and fixture have been tested as an assembly. The proposed fixture products assembly is certified by the Manufacturer to function within the required temperature, lumen output, electrical characteristics and operational life described in the Contract Documents".
- C. Light Fixture Samples
1. If requested by the District's Representative, provide a sample of each fixture proposed as a substitution for a specified fixture. Sample fixture shall be complete with specified lamps, 3-wire grounding "SO" cord and plug for 120-volt 60Hz, AC plug-in operation. Sample fixtures shall be delivered to the District's Representative's office for review, the samples shall be picked up within 10-working days after review comments have been received; any samples left beyond this time will be discarded by the District's Representative. Decision of District's Representative regarding acceptability of any lighting fixture is final.

1.03 QUALITY ASSURANCE (ADDITIONAL REQUIREMENTS)

- A. Work and materials shall be in full accordance with the latest Rules and Regulations. The publications shall be included in the Contract Document Requirements. If a conflict occurs between the following publications and any other part of the Contract Documents, the Requirements describing the more restrictive provisions shall become the applicable Contract definition:
1. UL – Underwriters' Laboratory:
 - a. UL – 8750 and 1598C: Light Emitting Diode – LED Equipment for use in Lighting Products and Replacements
 2. NEMA – National Electrical Manufacturers Association:
 - a. NEMA – LE4: Recessed Luminaires Ceiling Compatibility
 - b. NEMA – SSL #1, #3 and #6: Electronic Drivers for LED; LED and Incandescent Lamp Replacement
 - c. NEMA – LSD #44, #45, #49 and #51: SSL-solid state lighting
 3. United States Federal Government:
 - a. FCC – Part 18: EMI and RFI emissions limitations.
 - b. EPA: Energy conservation publications and waste disposal regulations.
 4. ETL and C.B.M. Certified and Approved.
 5. Electrical installation Standards, National Electrical Contractors' Association:
 - a. NEIS/NECA and IESNA – 500: Recommended Practice for: Installing indoor Commercial Lighting Systems.
 - b. NEIS/NECA and IESNA – 501: Recommended Practice for installing Exterior Lighting Systems
 - c. NEIS/NECA and IESNA - 502: Recommended Practice for installing Industrial Lighting Systems.
 6. Illuminating Engineering Society – IES (IESNA):
 - a. IES – LM41: Photometric and Reporting.
 - b. IES – 587: Surge Protection.
 - c. IES – LM79: Solid State Lighting (SSL) Testing and Measurement.
 - d. IES – LM80: Testing for Lifetime of LED.
 7. ANSI-American National Standards Institute:
 - a. ANSI – C81
 - b. ANSI – C82
 - c. ANSI – C62.41: Transient Withstand
 - d. ANSI – C78: Lamps
 8. State California Code of Regulations - Title-24: Energy Code

PART 2 - PRODUCTS

2.01 GENERAL

- A. Complete Fixture
1. Provide light fixtures complete including lamps, ballasts, lamp holders' sockets, housings, ceiling, and wall trim "rings" for each ceiling type, mounting and adapter support brackets, diffusers/lenses, and outlet boxes.
 2. Include an allowance of \$300.00 to provide a light fixture for each lighting fixture outlet shown on Drawings without a fixture type designation.
- B. Specific Fixture Requirements and Fixture Schedule Information
1. The catalog numbers included in the description of the various types of lighting fixtures shall be considered to establish the type or class of the fixture with a particular Manufacturer only. The fixture length, number of lamps and lamp

types, component materials, accessories, mounting type, ceiling, wall and install adapters, operation voltage, and all other components required to fulfill the total description of the fixture based on all Drawing information, branch circuits, voltages, Specification information, and shall be included in the Contract Requirements regardless of whether or not the catalog number specifically includes these components.

2. Lighting fixtures shall be the types as indicated in fixture schedule on the Drawings and as described in the Specifications.
3. All fixtures of the same fixture type shall be the same Manufacturer and of identical finish and appearance, unless indicated otherwise on Drawings.

C. Manufacturer Certification of Operation

1. Lamps and power supplies (drivers) shall be recommended and certified by the respective Manufacturer(s), to be "matched" to operate correctly together, within the published characteristics, for efficacy, lamp starting, operating life hours, lumen output, power factor, power input, operating line ampere, sound intensity, and temperature.

2.02 BALLASTS AND POWER SUPPLIES (FOR HID LAMPS AND FLUORESCENT LAMPS AND DRIVER-POWER SUPPLIES FOR LED-SOLID STATE LAMPS)

A. General

1. All ballast, power supplies, lighting fixtures assemblies and components shall be ANSI, ETL Approved C.B.M. Certified and UL labeled.
2. Ballasts shall provide Class "P" thermal protection.
3. Ballasts shall comply with FCC Part 18 Class-A and NEMA limits as to EMI or RFI and not interferes with normal operation of electrical or electronic data processing equipment.
4. Open circuit voltage, starting voltage, crest voltage and lamp-operating voltage shall comply with Requirements of the respective Manufacturer of the installed lamps.
5. Lamp ballasts, power supplies and transformers shall be for use with the specific lamps provided as part of the Contract.
6. Shall be suitable for use with automatic occupancy motion sensing type switching "on-off" control systems, with multiple "on-off" cycles per hour, on a 24-hours a day basis. Operation shall be without loss of performance in operating characteristics described in the Contract Documents.
7. Fusing
 - a. Shall be independently fused on the incoming line side within the fixture compartment.
 - b. Alternately the Ballast Manufacturer may install the equipment fuse inside the ballast/power supply.
 - c. Provide a label next to ballast cover reading: "Ballast (Power Supply) is fused, check fuse prior to relamping". Provide an additional quantity of 10% spare fuses and deliver to District's Representative.
8. Ballast sound rating Class-A or better. Where sound-rating classification is not published, the ballast sound rating shall be the best of product manufactured. Ballasts, which are judged by the District's Representative to be excessively noisy, shall be removed and replaced at the Contractor's expense with low noise ballasts.
9. Electronic solid-state ballasts and power supplies shall be the product of Manufacturer that has been producing electronic ballasts/power supplies for a minimum of five consecutive years prior to the date of the Contract.

10. Provide low temperature rated ballasts and power supplies in lighting fixtures installed outdoors; in non-heated building spaces; inside walk-in refrigerators/freezers, cold storage spaces. The minimum starting temperature rating shall be not less than zero-degrees Fahrenheit.
 11. Shall be designed and supplied to operate on the incoming line voltage system circuits to which the respective light fixtures are connected.
 12. Shall not contain any PCB (Polychlorinated Biphenyl).
 13. Power factor shall be not less than 0.90, starting and operating. The input starting transient line input ampere should never exceed lamp normal operating ampere by more than 10%.
 14. Ballast and power supply disconnect:
 - a. Lighting Fixture Manufacturer factory installed and prewired inside each light fixture, for lamp-ballast or lamp-driver power supply.
 - b. Shall comply with UL-2459 and CEC/NEC. Shall disconnect (load-break) energized or de-energized ballast/driver from respective line voltage circuit and dimming circuit. UL-94V-0 flame retardant.
 - c. Hot pluggable, multi-pole, insulated connectors, with strain relief and finger-safe squeeze-to-release latching function.
 - d. Suitable for available voltage and ampere dimming and non-dimming lamp-ballasts and lamp-power supplies.
 15. Ballast and power supplies as manufactured by General Electric, Advance, Philips, Universal, Sylvania/Osram or equal.
- B. Dimming Ballasts and Lighting Control System Ballasts
1. General
 - a. The light fixture ballasts shall comply with the recommendations of the Lighting Control System Manufacturer, as to ballast type and Ballast Manufacturer sources. Provide documentation with Shop Drawings certifying compliance with the Requirements.

2.03 LIGHT FIXTURES (LUMINAIRES)

- A. General
1. Lighting fixtures shall have all parts, ballasts, sockets, support attachments, trim flanges, and fittings necessary to complete and properly install the fixture at the indicated installation locations. All fixtures shall be provided with lamps of size and type specified.
 2. Ceiling and/or wall surface mounted lighting fixtures shall not have any exposed chase nipples or conduit knockouts visible to view within fixture housing. Lighting fixtures mounted in continuous rows shall have chase nipples or conduit knockouts between lighting fixture housing but shall not have visible chase nipples/conduit knockouts on the visible ends of the continuous row of lighting fixtures.
 3. Where fixture color is indicated to be selected by the Architect and/or District's Representative, provide two color chip samples for each color for review.
 4. Recessed fixtures with attached junction box shall be provided with a junction box permanently attached to the plaster ring so that the junction box is accessible through the fixture opening when the fixture is removed. Connection between fixture and pull box shall be flexible metal conduit with not less than 16AWG "AF" or "CF" type fixture rated copper wires, high temperature wire insulation for not less than 600 volts AC. The flexible conduit shall be sufficient length, so that when the fixture is removed, the pull-box is readily accessible.

5. Recessed fixtures shall be Underwriters' Laboratory approved for recessed installation with plaster frame and attached pull box. Lamp enclosure, reflectors and finish wiring shall not be installed until plastering is completed. Exposed finish trim shall not be installed until finish painting of the adjacent surface is completed.
6. The fixture shall bear Underwriters' Laboratory label of approval for the wattage and installation indicated.
7. Light fixtures installed outdoors, in damp or wet locations shall be UL labeled for said location as "damp-location" and "wet-location" for the respective installation location.
8. Fixtures in contact with thermal/building insulation shall be UL listed and rated for direct contact installation in thermal insulation systems.
9. Lamp auxiliary support brackets shall be heat-resistant, non-dielectric. Alternatively, metal auxiliary lamp support brackets shall be electrically isolated from the fixture, to prevent glass decomposition.
10. Lighting fixtures installed in masonry and/or concrete construction. The fixture housing shall be rated for "concrete-pour" installation location.
11. Provide a permanent label inside each light fixture stating the following relamping information. Not less than 0.125-inch high black alphanumeric characters on white background.
"Replacement lamp(s) installed in this light fixture must comply with the following criteria:
 *: CRI *: Lamp Watts
 *: CCT-K *: Lamp Lumens
 Only lamp rated * type lamp ballast shall be installed in this fixture."
*Insert the value required for the specific lamp required by the Contract Documents for each light fixture.

B. Lens and Diffusers

1. Acrylic plastic or Plexiglas for the light fixture diffusers or fixtures lenses shall be 100% virgin material.
2. Thickness of not less than 0.125-inch, as measured at the "THINIST" portion on the diffuser or lens. However, thickness shall be increased to sufficient construction and camber to prevent the lens and diffusers from having any noticeable sag over the entire normal life of the installation.
3. Diffusers shall be formed from cast sheet by a vacuum and/or pressure technique.
4. Lighting fixtures containing lamps with dichroic reflectors and light fixtures with non-dichroic lens/diffuser shall be rated for high temperature lamp operations resulting from lamp heat redirected (reflected) back into the fixture.

C. Fixture/Luminaire Internal Wiring

1. Provide wiring between lamp holders and associated operating and starting equipment. Provide ballasts/transformers inside lighting fixture.

2.04 SOLID STATE LIGHTING (SSL), LIGHT EMITTING DIODES (LED) LAMPS, POWER SUPPLIES, AND LIGHT FIXTURES (ADDITIONAL REQUIREMENTS)

A. General

1. Solid State LED light source (lamps), related control equipment (driver-power supply), and luminaire (light fixture) optics for light output distribution.
2. Shall comply with the US-DOE Energy Star Program for SSL-LED. Submit documentation with Shop Drawings.

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3. Shall comply with the latest revision IESNA LM-79 and LM-80. Submit documentation with Shop Drawings.
 4. SSL chromaticity shall comply with latest revision NEMA and ANSI – C78.377. Submit documentation with Shop Drawings.
 5. Submit with Shop Drawings two samples of each light fixture type employing SSL, with prewired 120 volt, 60Hz AC “SO” cord and plug-in cap.
- B. LED Lamps
1. Lamp lumen output and overall efficiency shall be based on the LED lamps installed in specified fixture and ambient operating temperature.
 2. Lamp Color Rendition Index (CRI) shall equal or exceed CRI – 80, unless noted otherwise on Drawings.
 3. Lamp color output shall be 4000-degree K (\pm 100K), unless noted otherwise on Drawings.
 4. CRI and lamp color temperature shall be same for all light fixtures of the same fixture type.
- C. LED Power Supply (driver)
1. Combination of power supply and SSL – lamp shall be Tested and Certified by respective Manufacturers for performance and proper operation.
 2. Provide dimming type driver where indicated on Drawings. Driver and dimming equipment shall be Tested and Certified by respective Manufactures for performance and proper operation.
- D. Self-Contained LED Lamp and Driver, Integral “Screw-Base” and/or “Pin-Connect”, replacement assembly for Incandescent Lamps.
1. Shall be dimmable. Dimmer and lamp shall be certified by Respective Manufacturers for compatible correct operation with each other.
 2. Optical system and operating temperature thermal performance shall be compatible with light fixture.
 3. Comply with latest revisions of NEMA LSD-49 and SSL-6.

2.05 LIGHTING STANDARDS (SUPPORT POLES, POLE MOUNTED LIGHTING FIXTURES AND LUMINAIRES)

- A. General
1. Lighting poles, pole bases, pole arms, lighting fixtures (luminaires), supports with all lighting pole attachments and anchors shall be designed and constructed to withstand not less than 100 mile per hour steady horizontal wind loading and 130 mile per hour horizontal wind gust loading, without any damage to the Lighting Standards.
 2. Provide tamper-resistant "hand-hole" and cover on the pole, for access into wiring terminations inside the pole. Provide ground "lug" attachment for equipment bond conductor.
 3. Provide factory applied weather protective base undercoat and final finish on all exposed and internal components. Color as indicated or as selected by District's Representative.
- B. Base Plate
1. Provide a base plate at the bottom of each pole to attach and secure the pole to the pole anchor bolts. The base plate shall be permanently attached to the bottom of the pole.

C. Anchors

1. Anchor bolts shall be threaded the entire bolt length, not less than four bolts for each pole equally spaced around the pole base. Provide a minimum of two threaded nuts for each anchor bolt. Install a nut on the top and bottom sides of each base plate anchor bolt location. Not less than four threads shall be exposed after pole is installed and leveled.

PART 3 - EXECUTION

3.01 LIGHT FIXTURE INSTALLATION

A. General

1. The Contractor shall verify actual ceiling and wall construction types as defined on the Architectural Drawings and furnish all lighting fixtures with the correct mounting devices, trim rings, brackets whether or not such variations are indicated by fixture catalog number. The Contractor shall verify depth of all recessed lighting fixtures with Architectural Drawings prior to ordering fixtures. Any discrepancies that would cause recessed lighting fixtures not to fit into ceiling shall be reported to the District's Representative prior to release of order to the Supplier of the fixtures.
2. On acoustical tile ceilings, fixture outlets shall be accurately located in the center, at the intersection of the four corners or at the center of the joints of two tiles.
3. The Contractor shall aim the exterior adjustable lighting fixtures after dark in the presence of, and at a time convenient to the District's Representative.
4. Fixtures shall be ordered and furnished to operate correctly on the branch circuit voltage connected to the respective fixture as shown on the Site Plan and Floor Plan Electrical Drawings. The voltages shown on the fixture schedule are for generic fixture information only.
5. Install and connect lighting fixtures to the circuits and control sequences indicated on the Drawings and to comply with respective Manufacturer's instructions/recommendations.
6. Lighting fixtures in building interstitial spaces, in mechanical plumbing and electrical spaces/rooms, are shown in their approximate locations. Do not install lighting outlets or light fixtures until the mechanical, plumbing, and electrical equipment/pipes/ductwork are installed; then adjust and install lighting in revised clear (non-interfering) locations to provide best even-illumination. Coordinate the locations with all other trades prior to lighting installation.
7. Provide conduit and DALI Loop (Bus) communications lighting control network circuit connections, to each light fixture with DALI ballasts.

B. Lighting Fixtures Installed in Ceiling Support Grids - Suspended Lay-in "T-bar" and Concealed Spline Ceilings.

1. Provide two seismic clips at opposite ends of each recessed light fixture, the clip shall connect to the ceiling grid main runners and the light fixture. The light fixture with seismic clips and ceiling grid runner connections shall resist a horizontal seismic force equal to the total weight of the light fixture assembly.
2. Each light fixture weighing 40-pounds or less and where the respective ceiling grid system is "heavy duty" type, shall be suspended directly from the ceiling grid or shall be suspended independent of the ceiling grid support system as approved by the AHJ. Each light fixture weighing more than 40-pounds or

where the ceiling grid system is not a "heavy duty" type shall be supported independent of the ceiling grid and independent of ceiling grid support system.

3. Each light fixture supported independent of the ceiling grid system shall be supported with a minimum of four taut independent support wires, one wire at each fixture corner.
4. Each light fixture supported directly from the ceiling grid or ceiling grid support system shall be additionally connected with a minimum of two independent slack safety support wires. One wire at each opposite diagonal fixture corner. Each 3-feet by 3-feet and larger light fixture shall be supported in the same manner, except provide a minimum of four independent slack safety wires, one at each fixture corner.
5. Light fixtures surface mounted to a suspended ceiling shall be installed with a 1½-inch steel – "C" channel which spans across and above a minimum of two parallel main ceiling grid "runners" and concealed above the ceiling. Each channel or angle member shall be provided with a minimum of two threaded studs for attaching to the fixture housing through the lay-in ceiling tile. Two steel "C" channel members shall be installed for each 4-foot (or smaller) fixture. Install the channels within 6-inches of each end of the light fixture to span a minimum of two ceiling grid parallel main runners. Provide two seismic clips connecting the ceiling grid main runners to each steel – "C" channel. Provide a not less than two taut independent support wires connecting to each channel. Bolt the light fixtures to the threaded studs on the channels or angles, to support the light fixture tight to the ceiling surface.

C. Fixture Supports

1. The support wires for light fixture support shall be 12-gauge steel (minimum). The wires including their building and light fixture attachments shall provide support capacity of not less than four times the weight of the light fixture assembly. Provide additional light fixture support wires and building anchors to meet these Requirements, as part of the Contract. The support wires shall be anchored to the building structural elements above the ceiling.
2. Pendant mounting fixtures shall be supplied with swivel hangers. Fixtures shall swing in any direction a minimum of 45 degrees of gravity, position. Fixtures shall have special stem lengths to give the mounting height indicated on the Drawings. Stem to be single continuous piece without coupling, and to be finished the same color as the canopy and the fixture, unless otherwise noted. The Contractor shall check all lock nuts and set screws to rigidly secure the swivel socket to the stem, and the stem to the outlet box. Fixtures shall be plumb and vertical. Where obstructions occur restricting 45-degrees free-swing of fixtures, the fixtures shall be "guy" wired to prevent fixtures from striking obstructions. The District's Representative shall approve method of guying. Swinging fixtures shall have an additional safety hanger cable attached to the structure and the fixture at each support, with the capacity of supporting four times the vertical weight of the light fixture assembly.
3. Suspended fixtures weighing in excess of 40-pounds shall be supported independently of the fixture outlet box. Provide "aircraft" (minimum 12 gauge) steel hanger cable for suspended fixtures route cable concealed or in pendant where possible. Each cable attachments shall support four times the weight of the fixture assembly. Securely attach the cable to the building structure.
4. Surface mounted fixtures installed on drywall or plaster ceilings and weighing less than 40-pounds may be supported from outlet box. Provide structural supports above drywall or plaster ceilings for installation of fixtures weighing

more than 40-pounds and secure fixture to structural supports. The use of toggle bolts is prohibited.

- D. Recessed Lighting Fixtures - Fire Rated Building Surfaces
 - 1. Lighting fixtures recessed in ceiling or wall which has a fire resistive rating of 1-hour or more shall be enclosed in a fully enclosed backbox (except over fixture lens/diffuser). The material used to fabricate the "enclosed backbox" shall have a fire rating equal to that of the respective ceiling or wall.
 - 2. The space from the fixture to the box enclosure shall be a minimum of 3-inches.
 - 3. The backbox shall be concealed behind the fire rated ceiling and wall finish surface. The light fixture shall be provided with lamp ballast rated for (normal light output) operation in a "high" ambient temperature.

3.02 LAMPS

- A. Lamps shall be the Type and Manufacturer as recommended by the Dimming System Manufacturer.
- B. Install all Lamps in each Light Fixture.
- C. Lamp and Light Fixture use during Construction:
 - 1. All lamps in lighting fixtures that have been operated (ON) for a total of more than 300-hours prior to final completion of the Contract Notice of Completion shall be relamped by the Contractor. Remove the existing lamps with more than 300-hours of illuminated operation and provide new lamps of the type required by the Contract Documents, install lamps in respective light fixtures, typical for the following lamp types:
 - a. LED

3.03 LENS AND DIFFUSERS

Lens, Diffusers, Internal Reflectors shall be completely cleaned of all dust, dirt and fingerprints after the installation of the light fixtures and lamps, and after all trades have completed work and prior to occupancy of the facility by the District.

3.04 COMMISSIONING LIGHTING FIXTURES (ADDITIONAL REQUIREMENTS)

- A. General
 - 1. Verify correct lighting control configurations and operation in each room.
 - 2. Simulate normal source power failure by "opening" (turn off) building main service disconnect and verify connections and operation of each emergency lighting fixture.
 - 3. Confirm "EXIT" sign directional arrows are visible in each "EXIT" sign.
 - 4. Verify light fixture support-hangers, ceiling grid clips and seismic restraints comply with the Contract Documents.
 - 5. Remove protective shipping/installation shields on fixtures. Verify fixtures and lamps are clean and free of construction debris. Clean light fixtures found to be contaminated or dirty.
 - 6. Setup, program, and function test lighting control systems to perform each of the indicated control functions, area/room zones and sequences.
 - 7. Provide "aiming", directional adjustment of light fixtures, both indoor and outdoor. Aiming shall comply with Manufacturer's aiming diagrams, and as directed by District's Representative.

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- B. Sample Spot-Check in each Room the following Lighting Fixture information:
1. Lamp type and performance data.
 2. Ballast type and performance data.
 3. Combined Lamp/Ballast Certification of performance and compatibility by respective Manufacturer.
 4. Verify instructional signage is placed inside each lighting fixture in compliance with Contract Documents.

**END OF SECTION 26 5000
101320/229099**

SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to, the following:
 - 1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
 - 2. Electrical General Provisions and Requirements for electrical work.
 - 3. Division-1; General Requirements; General Conditions.
- B. Organization of the Specifications into Divisions, Sections and Articles, and arrangement of Drawings shall not control the Contractor in dividing the Contract Work among Subcontractors or in establishing the extent of work to be performed by any trade.

1.02 GENERAL SUMMARY OF ELECTRICAL WORK

- A. The Specifications and Drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material for the proper execution of the work in accordance with present practice of the trade shall not relieve the Contractor from providing such additional labor and materials.
- B. Refer to the Drawings and Shop Drawings of other trades for additional details, which affect the proper installation of this work. Diagrams and symbols showing electrical connections are diagrammatic only. Wiring diagrams do not necessarily show the exact physical arrangement of the equipment.
- C. Before submitting a bid, the Contractor shall become familiar with all features of the Building Drawings and Site Drawings, which may affect the execution of the work. No extra payment will be allowed for failure to obtain this information.
- D. If there are omissions or conflicts between the Drawings and Specifications, clarify these points with the District's Representative before submitting bid and before commencing work.
- E. Provide work and material in conformance with the Manufacturer's published recommendations for respective equipment and systems.

1.03 LOCATIONS OF EQUIPMENT

- A. The Drawings indicate diagrammatically the desired locations or arrangements of conduit runs, outlets, equipment, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structure conditions encountered.

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- B. Where outlets are placed on a wall, locate symmetrically with respect to each other, furniture, cabinets, and other features or finishes on the wall.
- C. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without cost to the Contract, providing the change is ordered before the conduit runs, etc., and work directly connected to same is installed and no extra materials are required.
- D. Coordinate and cooperate in every way with other trades in order to avoid interference and assure a satisfactory job.
- E. The location of the existing utilities, building, equipment and conduit shown on the Drawings is approximate. Verify exact locations and routing of existing systems by potholing all trench routes prior to digging the trench. Pothole at least 100 feet ahead of the actual trenching to allow space to alter the new conduit routing to accommodate existing conditions.
- F. Underground Detection Services Existing Utility Structures
 - 1. Detection/location services shall be provided utilizing the latest detection equipment available. Services shall be performed by a company regularly engaged in the business of existing Underground Utility Structure Detection for the past 5-years.
 - 2. Prior to excavation and prior to directional boring the following work shall be performed:
 - a. Contractor to mark excavating and trenching/ directional boring locations and indicate width and depth.
 - b. Locate, by way of vertical and horizontal control dimensions, existing subgrade petroleum product pipes, process piping, conduits, sewer, water, gas, storm drain, electrical, telephone, and irrigation lines in the affected areas of Contract Construction Work.
 - c. Arrange and meet with the District's Representative to review existing underground conditions.
 - d. The proposed route of each excavation shall be continuously surveyed along the entire excavation path using Ground-Penetrating Radar (GPR) operating from the surface grade. The GPR shall detect and map existing underground metal and non-metal, both private and public utility lines, pipes, conduits, conductors, etc. The GPR shall identify the horizontal and vertical location of existing underground conditions located at a depth of up to 3-meters below finish grade and located with a vertical and horizontal accuracy within ± 12 -inches of actual condition. The Contractor shall add this information to the existing conditions site plan.
 - 3. Exercise extreme caution in directional boring, excavating and trenching on this site to avoid existing underground utilities and structures, and to prevent hazard to Personnel and/or damage to existing underground utilities or structures. The Contract Documents, Drawings and Specifications do not include necessary components for construction safety, which is the responsibility of the Contractor.
 - 4. Repair/replace, without additional cost to the Contract, and to the satisfaction of the District any existing work damaged that was identified in the Record Drawings provided; Identified by the District's Representative; Identified by the Underground Detection Services performed; or any existing work damaged as a result of failure to comply with all the Referenced Requirements.

5. The Contractor shall contact Common Ground Alliance (CGA) telephone #811 "Know What's Below-Call Before You Dig" and Underground Service Alert (USA), not less than 72-hours prior to excavation. Contractor shall not excavate until verification has been received from CGA and USA that existing underground utilities serving the site have been located, identified, and marked.
- G. The locations of existing underground utilities, where shown on Drawings, are shown diagrammatically and have not been independently verified by the District, the District's Representative, the Architect/Engineer. The District, the District's Representative, and the District's Architect/Engineer are not responsible for the location of underground utilities or structures, whether or not shown or detailed and installed under this or any other Contracts. The Contractor shall identify each existing utility line prior to excavation and mark the locations on the ground of each existing utility line.

1.04 PERMITS

Take out and pay for all Required Permits, Inspections and Examinations without additional cost to the District.

1.05 QUALITY ASSURANCE

- A. Work and materials shall be in full accordance with the latest Rules and Regulations as follows. The following publications shall be included in the Contract Documents Requirements. If a conflict occurs between the following publications and any other part of the Contract Documents, the Requirements describing the more restrictive provisions shall become the applicable Contract definition:
 1. California Code of Regulations Title 24.
 2. California Part 3 "California Electrical Code" CEC, Title 24 and Title 8 "Division of Industrial Safety".
 3. California Building Code – CBC.
 4. California Fire Code – CFC
 5. The National Electrical Code – NEC/NFPA 70.
 6. International Building Code – IBC.
 7. National Fire Protection Agency – NFPA.
 8. National Fire Alarm Code – NFAC/NFPA 72.
 9. Underwriter's Laboratory – UL.
 10. Other applicable State and Local Government Agencies Laws and Regulations.
 11. Electrical Installation Standards National Electrical Contractors Association (NECA) and National Electrical Installation Standards (NEIS):
 - a. NECA/NEIS-1: Standard of Practices for Good Workmanship in Electrical Contracting
 - b. NECA/NEIS-101: Standard for Installing Steel Conduit (Rigid, IMC, etc.)
 - c. NECA/NEIS-104: Recommended Practice for Installing Aluminum Building Wire and Cable
 - d. NECA/NEIS-105: Recommended Practice Installing Metal Cable Trays
 - e. NECA/NEIS-111: Recommended Practice Installing Nonmetallic Raceways
 - f. NECA/NEIS-230: Recommended Practice for Installing Motors
 - g. NECA/FOA-301: Standards for Installing and Testing Fiber Optic Cables
 - h. NECA/NEIS-305: Standard for Fire Alarm System Job Practice

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- i. NECA/NEIS-331: Standards for Installing Building and Service Entrance Grounding
 - j. NECA/NEIS-400: Recommended Practice for Installing and Maintaining Switchboards
 - k. NECA/NEIS-402: Recommended Practice for Installing and Maintaining Motor Control Centers
 - l. NEIS/NECA and EGSA-404: Recommended Practice for installing Generator Sets
 - m. NECA/NEIS-405: Recommended Practices for installing and Commissioning Interconnected Generation Systems
 - n. NECA/NEIS-407: Recommended Practice for Installing Panelboards
 - o. NECA/NEIS-408: Recommended Practices for Installing Busway
 - p. NECA/NEIS-409: Recommended Practice for Installing and Maintaining Dry-Type Transformers
 - q. NEIS/NECA and IESNA-500: Recommended Practice for Installing indoor Commercial Lighting Systems
 - r. NEIS/NECA and IESNA-501: Recommended Practice for Installing Exterior Lighting Systems
 - s. NEIS and IESNA-502: Recommended Practice for Installing Industrial Lighting Systems
 - t. NECA/BICSI-568: Standards for Installing Commercial Building Telecommunications System
 - u. NECA/NEIS-600: Recommended Practice Installing Medium-Voltage Cable
- B. All material and equipment shall be new and shall be delivered to the site in unbroken packages. All material and equipment shall be listed and labeled by Underwriters Laboratories or other recognized Testing Laboratories, where such listings are available. Comply with all Installation Requirements and restrictions pertaining to such listings.
- C. Work and material shown on the Drawings and in the Specifications are new and included in the Contract unless specifically indicated as existing or N.I.C. (not in Contract).
- D. Keep a copy of all applicable Codes and Standards available at the job site at all times for reference while performing work under this Contract. Nothing in Plans or Specifications shall be construed to permit work not conforming to the most stringent of Building Codes.
- E. Where a conflict or variation occurs between applicable Codes, Standards and/or the Contract Documents, the provisions of the most restrictive provision shall become the Requirement of the Contract Documents.

1.06 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. General
- 1. Review of Contractors' submittals is for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action shown is subject to the Requirements of the Plans and Specifications. Contractor is responsible for quantities; dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of work with that of all other trades and satisfactory performance of their work.

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2. The Contractor shall review each submittal in detail for compliance with the Requirements of the Contract Documents prior to submittal. The Contractor shall "Ink Stamp" and sign each item of the submittal with a statement "CERTIFYING THE SUBMITTAL HAS BEEN REVIEWED BY THE CONTRACTOR AND COMPLIES WITH ALL THE REQUIREMENTS OF THE CONTRACT DOCUMENTS". The Contractor shall clearly and specifically identify each individual proposed substitution, substitution of equal or proposed deviation from the Requirements of the Contract Documents with a statement "THIS ITEM IS A SUBSTITUTION".
The burden of research, preparation of calculations and the furnishing of adequate and complete Shop Drawings information to demonstrate the suitability of Contractor's proposed substitutions and suitability of proposed deviations from the Contract Documents is the responsibility of the Contractor.
3. Departure from the submittal procedure will result in resubmittals and delays. Failure of the Contractor to comply with the Submittal Requirements shall render void any acceptance or any approval of the proposed variation. The Contractor shall then be required to provide the equipment or method without variation from the Contract Documents and without additional cost to the Contract.
4. The Contractor at no additional cost or delays to the Contract shall remove any work, material and correct any deficiencies resulting from deviations from the Requirements of the Contract Documents not approved in advance by the District prior to commencement of work.
5. Shop Drawings submitted by the Contractor, which are not specifically required for submittal by the Contract Documents, or Contractor Shop Drawings previously reviewed and resubmitted without a written resubmittal request to the Contractor, will not be reviewed, considered, or commented on. The respective Shop Drawing submittal/ resubmittal will not be returned to the Contractor and will be destroyed without comment or response to the Contractor. The respective submittal shall be considered null and void as being not in compliance with the Requirements of the Contract Documents.
6. Refer to Division-1 for Additional Requirements.

B. Material Lists and Shop Drawings

1. Submit material list and Equipment Manufacturers for review within 35 days of award of Contract. Give name of Manufacturer and where applicable, brand name, type and/or catalog number of each item. Listing of more than one Manufacturer for any one item of equipment, or listing items "as specified", without both make and model or type designation, is not acceptable. Shop Drawings shall not be submitted before review completion of Manufacturers list. The right is reserved to require submission of samples of any material whether particularly mentioned herein.
2. After completion of review of the Material and Equipment Manufacturers list, submit Shop Drawings for review. Shop Drawings shall be submitted in completed bound groups of materials (i.e., all lighting fixtures or all switchgear, etc.). The Contractor shall verify dimensions of equipment and be satisfied as to fit and that they comply with all Code Requirements relating to clear working space about electrical equipment prior to sub-mitting Shop Drawings for review. Submittals, which are intended to be reviewed as substitution or departure from the Contract Documents, must be specifically noted as such. The Requirements of the Contract Documents shall prevail regardless of the acceptance of the submittal.

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3. Shop Drawings shall include catalog data sheets, instruction manuals, Dimensioned Plans, elevations, details, wiring diagrams, and descriptive literature of component parts where applicable. Structural calculations and mounting details, signed by a Structural Engineer registered by the State of California, shall be submitted for all equipment weighing over 400-pounds, and shall be in compliance with Title 21 of the California Code of Regulations.
4. Each Shop Drawing item shall be identified with the Specification Section and paragraph numbers, lighting fixture types and Drawing sheet numbers; the specific Shop Drawing is intended to represent. Shop Drawings 11-inches by 17-inches or smaller in size shall be bound in three ring binders. Divider tabs shall be provided in the three ring binders identifying and separating each separate Shop Drawing submittal item. Shop Drawings larger than 11-inches by 17-inches, Shop Drawing pages/sheets submittals shall be sequentially numbered with unique alphanumeric numbering system to facilitate correspondence referencing identification of individual sheets.
5. The time required to review and comment on the Contractor's submittals will not be less than 14 calendar days, after receipt of the submittals at the office of FBA Engineering. The review of Contractor submittals and return to Contractor of submittals with review comments will occur in a timely manner conditioned upon the Contractor complying with all of the following:
 - a. The submittals contain complete and accurate information, complying with the Requirements of the Contract Documents.
 - b. Contractor's submittals are each marked with Contractor's approval "stamp", and with Contractor signatures.
 - c. The submittals are received in accordance with a written, Shop Drawing submittal schedule for each submittal. The Contractor distributes the schedule not less than 35-calendar days in advance of the Shop Drawing Submittals, and the schedule identifies the calendar dates, the Contractor will deliver the various submittals for review.
6. Shop Drawings shall include the Manufacturers projected days for shipment from the factory of completed equipment, after the Contractor releases the equipment for pro-duction. It shall be the responsibility of the Contractor to ensure that all material and equipment is ordered in time to provide an orderly progression of the work. The Contractor shall notify the District's Representative of any changes in delivery, which would affect the Project completion date.
7. Submittal Identification
 - a. Each submittal shall be dated: with submittal transmission date; sequentially numbered and titled with submittal contents identification and applicable Specification/Drawing references (*i.e., Submittal dated: 05/12/20 Submittal #4 Contents: Branch Circuit Panelboards Sheet #E5.1 and Transformers Specification Section 260500 Paragraph 2.11, etc.*).
 - b. Each resubmittal shall be dated: with original submittal date and resubmittal trans-mission dates; sequentially numbered with original submittal number and sequential resubmittal revision number and titled with submittal contents identification and applicable Specifications/ Drawing references (*i.e., Original Submittal Date: 05/12/20 Resubmittal Date: 10/09/20 Original Submittal #4 Resubmittal Revision R2 Contents: Transformer Resubmittal Specification Section - 260500 Paragraph 2.11, etc.*).
 - c. Contractor shall provide a written response narrative with each resubmittal. Describe each response-action, resubmittal addition, change

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and deletion. Correspond to each response to A/E specific review comment.

- C. The Contractor shall be responsible for incidental, direct and indirect costs resulting from the Contractor's substitution of; or changes to; the specified Contract Materials and Work.
- D. The Contractor shall pay, upon request by the District's Representative, a fee for the District's Representative time involved in the review of substitution submittals and design changes resulting from the Contractor's requested substitutions. The fee shall be not less than \$125.00 per hour but, in no case, less than stated in Division-1, whichever is greater.
- E. Maintenance and Operating Manuals
 - 1. The Contractor shall furnish three copies of type-written Maintenance and Operating Manuals for all electrical equipment, fire alarm equipment, sound system equipment, etc., to the District.
 - 2. Instruct the District's Personnel in correct operation of all equipment at completion of project. Provide the quantity and duration of instruction class as specified; but in no case less than two 4-hour duration separate instruction classes for each individual equipment group furnished as part of the Contract. Instruction classes shall be presented by Manufacturer's Authorized Field Service Engineer at the project site. Instruction class size shall be at the District's discretion, not less than one or more than fifteen students shall attend each instruction session. Submit fifteen written outline copies of the proposed instruction class curriculum, 14-days prior to the class-scheduled dates.
 - 3. Maintenance and operating manuals shall be bound in three-ring, hard-cover, plastic binders with table of contents. Manuals shall be delivered to the District's Representative, with an itemized receipt.
- F. Portable or Detachable Parts: The Contractor shall retain in his possession, and shall be responsible for all portable and detachable parts or portions of the installation such as fuses, keys, locks, adapters, locking clips, and inserts until final completion of Contract Work. These parts shall then be delivered to the District's Representative with an itemized receipt.
- G. Record Drawings (Additional Requirements)
 - 1. Provide and maintain in good order a complete set of Electrical Contract "Record" prints. Changes to the Contract to be clearly recorded on this set of prints. At the end of the Project, transfer all changes to one set of transparencies to be delivered unfolded to the District's Representative.
 - 2. The actual location and elevation of all buried lines, boxes, monuments, vaults, stub-outs and other provisions for future connections shall be referenced to the building lines or other clearly established base lines and to approved benchmarks. If any necessary dimensions are omitted from the Record Drawings, the Contractor shall, at the Contractor's own expense, do all excavation required to expose the buried work and to establish the correct locations.
 - 3. The Contractor shall keep the "Record" prints up to date and current with all work per-formed.
 - 4. Refer to Division-1 for Additional Requirements.

1.07 CLEANING EQUIPMENT, MATERIALS, PREMISES

All parts of the equipment shall be thoroughly cleaned of dirt, rust, cement, plaster, etc., and all cracks and corners scraped out clean. Surfaces to be painted shall be carefully cleaned of grease and oil spots and left smooth, clean and in proper condition to receive paint finish.

1.08 JOB CONDITIONS - PROTECTION

Protect all work, materials, and equipment from damage from any cause whatever and provide adequate and proper storage facilities during the progress of the work. Provide for the safety and good condition of all the work until final acceptance of the work by the District and replace all damaged or defective work, materials, and equipment before requesting final acceptance.

1.09 EXCAVATION, CUTTING, BACKFILL AND PATCHING ADDITIONAL REQUIREMENTS

A. General

1. Perform excavation, cutting, backfill, core drilling, directional boring, and patching of the construction work required for the proper installation of the electrical work.
2. Patching shall be of the same material, thickness, workmanship, and finish as existing and accurately match-surrounding work to the satisfaction of the District's Representative.
3. Prior to penetrating, coring, drilling, or cutting existing building elements, concrete and/or masonry, provide imaging equipment examinations of each specific location. The imaging process shall identify existing internal embedded components and locations, including structural elements/anchors, conduit, and piping that are present. Do not penetrate or damage the existing internal embedded elements. Imaging shall employ one of the following, with GPR methodology preferred:
 - a. Non-invasive imaging employing high frequency, Ground Penetrating Radar (GPR), single side echo reflection technology.
 - b. Non-invasive imaging employing x-ray radiography, through-and-through imaging technology.

B. Excavation Temporary Cover

1. Excavations for Contract work occurring in streets, vehicular drive areas, parking lots, sidewalks; any paved surface; or any area accessible to the public; provide temporary steel plating and shoring support for the plates, to completely cover the excavations under one or more of the following conditions:
 - a. Excavation shall not remain "open" for more than 4-calendar days; provide temporary plating.
 - b. Excavation shall not be "open" over weekends (Saturday, Sunday) or Holidays; provide temporary plating.
2. The temporary plating shall be a minimum of 0.75-inch thickness steel, but in no case shall the thickness be less than required to support AASHTO-H20 traffic loading.
3. Provide a minimum of two 100% open lane(s) (12-foot lane width) for vehicular traffic at all times during construction, for vehicle access to all areas.

1.10 IDENTIFICATION

- A. Equipment Nameplates
1. Panelboards, terminal cabinets, circuit breakers, disconnect switches, starters, relays, time switches, contactors, push-button control stations, and other apparatus used for the operation or control of feeders, circuits, appliances, or equipment shall be properly identified by means of descriptive nameplates or tags permanently attached to the apparatus and wiring.
 2. Provide nameplate label on electrical service entrance equipment describing available short circuit information calculated by the Contractor, including:
 - a. Calculation date, month-day-year.
 - b. Calculate maximum available short circuit fault current.
 - c. Description of parameters and changes affecting the Requirements for recalculation of the fault current information.
 3. Electrical equipment including switchgear, switchboards, electric panels and control panels, motor control centers, combination motor starters, transformers, disconnects, etc., shall each be labeled by the Manufacturer with "Electric-Arc-Flash" warning signs. The signs shall explain a hazard to personnel may exist if the equipment is worked on while energized or operated by personnel while energized. The sign shall instruct Personnel to wear the correct Protective Equipment/clothing (PPE) when working "Live" or operating "Live" electrical equipment and circuits.
 4. Nameplates shall be engraved laminated phenolic. Shop Drawings with dimensions and format shall be submitted before installation. Attachment to equipment shall be with escutcheon pins, rivets, self-tapping screws, or machine screws. Self-adhering or adhesive backed nameplates shall not be used.
 5. Provide black-on-white laminated plastic nameplates engraved in minimum ¼-inch high letters to correspond with the designations on the Drawings. Provide other or additional information on nameplates where indicated.
- B. Plates: All cover and device plates shall be furnished with engraved or etched designations under any one of the following conditions (minimum character size not less than 0.188 inch. Engraving shall indicate circuits and equipment controlled or connected):
1. More than two devices under a common coverplate.
 2. Lock switches.
 3. Pilot switches.
 4. Switches in locations from which the equipment or circuits controlled cannot be readily seen.
 5. Manual motor starting switches.
 6. Where so indicated on the Drawings.
 7. As required on all control circuit switches, such as heater controls, motor controls, etc.
 8. Receptacles other than standard 15-amp 120-volt duplex receptacles; shall indicate circuit voltage, ampere, phase and source circuit number.
 9. Where outlets or switches are connected to emergency power circuit; provide panelboard and circuit number engraved on plate.
 10. Low voltage and signal system outlets.

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- C. For equipment and access doors or gates to equipment containing or operating on circuits of more than 100 volts AC or DC nominal. Provide red-on-white laminated warning signs engraved in ½-inch high letters to read: "DANGER - 480 (*or applicable voltage*) VOLTS KEEP OUT AUTHORIZED PERSONNEL ONLY".
- D. Wire and Cable Identification
 - 1. Provide identification on individual wire and cable including signal systems, fire alarm, electrical power systems (each individual phase, neutral and ground), empty conduit pull ropes, and controls circuit.
 - 2. Permanent identification shall be provided at each termination location, splice location, pullbox, junction box and equipment enclosure.
 - a. Individual wire and cable larger than #6AWG or 0.25-inch diameter, shall be provided with polypropylene identification tag holders, with yellow polypropylene tags interchangeable black alphanumeric characters, character height 0.25 inch. Attach identification tags with plastic "tie" wraps, minimum of two for each tag. As manufactured by Almetek Industries- "EZTAG" Series; or TECH Products - "EVERLAST" Series.
 - b. Individual wire and cable #6AWG and smaller or smaller than 0.25 inch diameter, shall be provided with water and oil resistant, flexible, self-laminating pressure sensitive machine embossed plastic tags that wrap a minimum of 360 degrees around the wire/cable diameter. The entire tag shall then be covered with a clear flexible waterproof plastic cover wrapped a minimum of 540 degrees around the wire/cable diameter and completely covering the identification. As manufactured by Brady Identification; or 3M; or Panduit.
 - c. Each identification tag location shall indicate the following information: circuit number, circuit phase, source termination and destination termination equipment name (or outlet number as applicable).
 - 3. Install permanent identification after installation /pulling of wire/cable is complete, to prevent loss or damage to the identification.
- E. Cardholders and cards shall be provided for circuit identification in panelboards. Cardholders shall consist of a metal frame retaining a clear plastic cover permanently attached to the in-side of panel door. List of circuits shall be typewritten on card. Circuit description shall include name or number of circuits, area, and connected load.
- F. Junction and pull boxes shall have covers stenciled with box number when shown on the Drawings, or circuit numbers according to panel schedule. Data shall be lettered in a conspicuous manner with a color contrasting to finish.

1.11 TESTING

- A. The Contractor shall obtain an independent Testing Laboratory, provide all instrumentation, and perform tests on the electrical system and equipment as herein-after described and further directed by the District's Representative. The test shall be performed after the completion of all electrical systems included in the Contract Scope of Work. All tests shall be recorded and documented and submitted to the District's Representative for review.
 - 1. All Equipment and Personnel required for set-up and testing shall be provided by the Contractor.
- B. Test for Phase to Ground and Neutral Condition:
 - 1. Open main service disconnects.

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2. Isolate the system neutral from ground by removing the neutral disconnects link located in the service switchboard.
 3. Close all submain disconnects.
 4. Close all branch feeder circuit breakers.
 5. Turn all switches to "on" position, unplug all portable equipment from outlet receptacles.
 6. Measure the resistance of each phase to ground and phase to neutral. A properly calibrated "megger" type test instrument shall be used. The test voltage shall be a nominal 500 volts.
 7. Record all readings after 1-minute duration and document into a complete report.
 8. Isolating Grounds: In the event that low resistance ground neutral connections are found in the system, they shall be isolated and located by testing each circuit individually as outlined above. Make proper corrections to restore the resistance values to an acceptable value.
- C. Method of obtaining ground resistance shall be in accordance with the latest edition of the James G. Biddle (Plymouth Meeting, Pennsylvania) manual published on this subject.
1. Perform "fall-of-potential" three-point tests on the main grounding electrode of system per IEEE Standard No. 81, Section 8.2.1.5. when suitable locations for test rods are not available, a low resistance dead earth or reference ground shall be utilized.
 2. Perform the two-point method test per IEEE Standard No. 81, Section 8.2.1.1, to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.
- D. The Testing, Calibrating and Setting of all ground and ground fault equipment, circuit breakers, circuit device protection relays, and meters adjustable settings shall be by an independent Testing Laboratory. Set as recommended by the respective Manufacturer and coordination study so as to be coordinated with other protection devices within the electrical design. Bound and tabulated copies of the test and settings shall be sent to the District's Representative.
- E. Ampere and Voltage Measurements
1. Measure and record ampere and line voltage measurements under full load on all panel feeders, switchboard, and switchgear feeders, motor control centers and motor circuits provided in the Contract. Record measurements at the equipment tested and submit to the District's Representative for review.
 2. Ampere voltage readings shall be:
 - a. Phase A-B, A-C and B-C.
 - b. Phase A-Neutral, B-Neutral and C-Neutral.
 3. The ampere and voltage readings shall be not less than 20-minutes duration for each test. Record and submit the measured minimum, maximum and 20-minute average for each ampere and voltage value and test location. Voltage and ampere measurements shall occur at the connected load end of each respective feeder, not at the source of supply end of each feeder.
 4. Test equipment shall be accurate within plus or minus 1%.
 5. Branch circuit devices 40-amp or less and motor loads ten horsepower or smaller are excluded from Ampere and Voltage Testing Requirement.
 6. If, in the opinion of the District's Representative, the voltages and regulations are not met within acceptable limits, make arrangements with the serving utility

for proper electrical service. Retest feeder line voltages, and submit to District's Representative for review, after the Utility Company has completed corrective actions. Reset "voltage taps" on transformers provided or modified as part of the Contract Work, to adjust line voltages to within acceptable values, as directed by the District's Representative.

- F. The Contractor shall complete the following work before any electrical equipment is energized.
1. All equipment shall be permanently anchored.
 2. All bus connections and conductor/wire connections shall be tightened per Manufacturer's instructions and witnessed by the District's Representative.
 3. All ground connections shall be completed and identified. Perform and successfully complete all required megger and ground resistance tests.
 4. Feeders shall be connected and identified.
 5. The interiors of all electrical enclosures including busbars and wiring terminals shall be cleaned of all loose material and debris, paint, plaster, cleaners, or other abrasive is over spray removed and equipment vacuumed clean. The District's Representative shall observe all interiors before covers are installed.
 6. All wall, ceiling, and floor work and painting shall be completed within areas containing electrical equipment prior to installation of equipment. The equipment indoor rooms and spaces shall be weathertight, and weather protected from environmental incursions.
 7. All doors to electrical equipment rooms shall be provided with locks in order to restrict access to energized equipment.
 8. Electrical spaces and rooms shall not be used as storage rooms after power is energized.
 9. Outdoor electrical equipment enclosures and housings shall be weather protected.
 10. The electrical system time current Coordination and Arc-Fault Study shall be complete for circuit breakers, ground relays set, and circuit relay sets, fuses; set-up, tested and calibrated accordingly.

1.12 POWER OUTAGES

- A. All electrical services in all occupied facilities of the Contract Work are to remain operational during the entire Contract Period. Any interruption of the electrical services for the performance of this work shall be at the convenience of the District and performed only after consultation with the District's Representative. Work involving circuit outages shall be only at such a time and of such a duration as approved in writing. Work involving circuit outages for the work required to connect new equipment and disconnect existing equipment shall be performed at the convenience of the District.
- B. Contract Work involving outages or disruption of normal function in electrical power systems, telephone/communication systems, fire alarms, shall be performed during the following time periods. The Contract Work shall be phased to limit outages in the respective systems to the stated periods:
1. 11:30 p.m. Friday to 11:30 p.m. Sunday of the same weekend. Work shall occur on multiple weekend periods if a single weekend is not sufficient time to complete the work.
 2. The Contract Work involving outages shall be phased in multiple work time units, to comply with the permitted outage limitations.

- C. Work involving system outages to the building fire alarm system shall be performed only after consultation with the District and shall be only at such a time and of such duration as approved in writing. Contractor shall provide continuous "Fire-Watch" during fire alarm system outages and comply with AHJ "Fire-Watch" Requirements.
- D. Provide overtime work; double shift work; nighttime work; Saturday, Sunday, and holiday work to meet outages schedule.
- E. Provide temporary electrical power to meet the Requirements of this Article.
- F. Any added costs to Contractor due to necessity of complying with this Article shall be included in the Contract Scope of Work.
- G. When electrical work involving power disruptions to existing areas is initiated, the work shall proceed on a continuous basis without stopping until electric power is restored to the affected areas.
- H. The Contractor shall request in writing to the District's Representative a minimum of 3-weeks in advance, for any proposed electrical outage.

1.13 TEMPORARY ELECTRICAL POWER

- A. Provide temporary electrical power if work requiring power outages cannot be completed in time permitted and approved by the District's Representative.
- B. Temporary electrical power shall be a standby diesel engine generator. Voltage, frequency, regulation, etc. shall be equal to that of normal utility source. Exhaust system shall have a critical silencing muffler. Generator voltage shall match the existing secondary voltage required at the site. The Contractor shall furnish all necessary cables, switches, etc., to make all required connections to existing panels, feeders, etc. Generator shall be sized to adequately carry the demand load. If record of demand load is not available, size generator to match corresponding transformer, maximum capacity circuit as directed by the District's Representative.
- C. After completion of required usage of the temporary generators, prior to completion of the Project, the Contractor shall remove the generators. All temporary cables, switches, etc. shall be removed and all permanent equipment left in satisfactory condition.
- D. Each generator shall be housed in security type sound attenuated housing to prevent access by unauthorized personnel. Temporary power cables, connections, etc. shall be protected from unauthorized personnel.
- E. The Contractor shall be responsible for complete operation of the generator including Personnel, fuel supplies, proper safety precautions, etc. generator shall not be left unattended while in operation.
- F. The Contractor shall provide temporary construction lighting and power as required in areas where work is being performed. Temporary power arrangements, outages, installation, work schedules, etc., shall be submitted in writing 3-weeks prior to requested outage date, and approved by the District's Representative prior to start of work.

1.14 ASBESTOS, POLYCHLORINATED BIPHENYL (PCB) OR HAZARDOUS WASTE

- A. It is understood and agreed that this Contract does not contemplate the handling of asbestos, PCB or any hazardous waste material. If asbestos, PCB, or any hazardous waste material is encountered, notify the District's Representative immediately. Do not disturb, handle, or attempt to remove.
- B. Lighting Fixture Demolition Hazardous Materials
 - 1. The removal of existing lighting fixtures will generate hazardous material waste disposal Contract Documents.
 - a. The existing lighting fixture ballast contains PCB material.
 - b. The existing lighting fixture lamps contain mercury.
 - c. The existing lighting fixture internal wire insulation may contain asbestos.
 - 2. Remove, handle, store, contain, dispose of, and document the hazardous materials resulting from existing lighting fixtures work, as part of the Contract Requirements.

1.15 TIME/CURRENT COORDINATION, SHORT CIRCUIT, ARC-FLASH AND SERIES RATED EQUIPMENT

- A. Series Rated Equipment.
 - 1. Circuit Protective Devices Identified as "Series Rated" or "Current Limiting" (i.e., CLCB - Current Limiting Circuit Breaker; CLF - Current Limiting Fuse, etc.) shall be series rated and tested (UL 489 and CSA5) by the Manufacturer with all equipment and circuit protective devices installed downstream of the identified series rated or current limiting device.
 - 2. Provide nameplates on all equipment located downstream, including the CLCB and CLF devices, to comply with CEC/NEC paragraphs 110-22 and 240-83 "CAUTION SERIES RATED SYSTEM - NEW DEVICE INSTALLATIONS AND REPLACEMENTS SHALL BE THE SAME MANUFACTURER AND MODELS".
- B. Short Circuit, Coordination and Arc-Flash
 - 1. Perform Engineering Analysis and submit engineered settings for each equipment location, fuse, and circuit breaker device, showing the correct time and current settings to provide the selective Coordination within the limits of the specified equipment. Shall comply with the latest application standards of IEEE and ANSI. Provide electrical system short circuit worst case bolted-fault analysis, both 3-phase line-to-line and 1-phase line-to-ground calculations as part of the Coordination Analysis recommendations. Provide Electric Arc-Flash calculations as part of the Coordination Analysis recommendations.
 - 2. The information shall be submitted in both tabular form and on time current log-log graph paper, with an Engineering Narrative. Written narrative describing data, assumptions, analysis of results and prioritized recommendations, six copies.
 - 3. The goal is to minimize an unexpected but necessary electrical system outage and Personnel exposure to the smallest extent possible within the fault occurrence location, using the specified Contract Equipment. Shall comply with, but not limited to:
 - a. IEEE-242, Recommended Practices for Protection and Coordination of Industrial and Commercial Distribution.
 - b. IEEE-399, Recommended Practices for Industrial and Commercial Power System Analysis.
 - c. IEEE-1584, Guide to Performing Arc-Flash Hazard Calculations.

- d. CEC/NEC
- 4. Provide permanent warning labels on each equipment location. The labels shall describe Arc-Flash, Short-Circuit and Time/Current Coordination, including safety precautions and protective clothing. Also described actions to be taken if any circuit changes or equipment modifications occur.
- 5. Shall be submitted with the Shop Drawing submittals for the respective equipment.
- 6. The Contractor shall independently contact the serving Utility Company to obtain the current system short circuit amps or available fault current.
- 7. The Contractor shall independently obtain As-Built Drawings for the existing infrastructure to establish lengths. If As-Built Drawings are no available, the Contractor shall research existing conditions and make reasonable but conservative estimates of conductor length. Where existing conductors have been re-used, the Contractor shall confirm conductor quantity, size, and conduit type.

1.16 INDEPENDENT TESTING LABORATORY

- A. Testing Laboratories Definition
 - 1. The Testing Laboratory shall meet Federal OSHA criteria for accreditation of Nationally Recognized Testing Laboratories (NRTL) Title 29 Part 1907 and 29 CFR-1910.
 - 2. Membership in the National Electrical Testing Association (NETA) shall also constitute acceptance of meeting said criteria, for testing of electrical systems.

1.17 EQUIPMENT SEISMIC AND WIND LOAD REQUIREMENTS (ADDITIONAL REQUIREMENTS)

- A. Refer to Structural, Architectural, and Soils report Contract Documents for Additional Requirements.
- B. General
 - 1. Equipment supports and anchorage is provided as part of the Contract shall be designed, constructed and installed in accordance with the Earthquake Regulations of the California Building Code (CBC), International Building Code (IBC).
 - 2. Provide equipment anchorage details, coordinated with the equipment mounting provision, prepared, signed and "stamped" with PE registration in good standing, by a Civil or Structural Engineer licensed as a Professional Engineer (PE) in the State of California.
 - 3. Mounting recommendations shall be provided by the Manufacturer based upon approved shake-table tests used to verify the seismic design of that type of equipment.
 - 4. The Equipment Manufacturer shall document the details necessary for proper wind-load and seismic mounting, anchorage, and bracing of the equipment for floor, ceiling, and wall/back installation location.
 - 5. Seismic performance shall be based on actual install location of the respective equipment in the building and height above or below grade.
 - 6. The Seismic Requirements are typical for each equipment item exceeding 19-pounds, including but not limited to the following:
 - a. Switchgear, switchboards, and motor control equipment
 - b. Transformers
 - c. Equipment racks and terminal cabinets

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- d. Panels
- e. Conduits with floor, ceiling or wall attachment support and conduits with suspension attachments.
- f. Busway, wire way and cable tray
- g. Uninterruptable Power Supplies (UPS)
- h. Inverters
- i. Generators and related equipment
- j. Lighting equipment
- k. Fire alarm equipment

C. Certification

- 1. Electrical Equipment Manufacturers and Contractor shall provide Special Seismic Certification (SCC) for each specific equipment configuration with shake-table verification, all furnished as part of the Contract Documents Requirements. The SCC shall include the specific installation location characteristics of the respective equipment including as follows:
 - a. Ground or floor attachment
 - b. Wall attachment
 - c. Ceiling attachment
 - d. Roof attachment
- 2. Wind Loading
Electrical equipment and anchorages shall withstand the wind-load imposed at the install location. Wind Loading Withstand Requirements shall apply to all electrical equipment installed in outdoor locations and to all electrical equipment exposed to the weather. The equipment shall be tested and certified by the Manufacturer and Contractor. The wind-load withstand qualification of the equipment and anchorages shall be verified by the following methods:
 - a. Aerodynamic wind tunnel test method.
 - b. Analytical calculation method, for oversized equipment too large for wind tunnel test method.
- 3. The wind-load withstand rating and the SCC shall comply with the Requirements of the Authority Having Jurisdiction (AHJ), and include the latest revisions, but not limited to the following:
 - a. American Society of Civil Engineers; ASCE-7
 - b. CBC/IBC; including but not limited to Sections 1702, 1708, 1709, 1708A and 1709A.
 - c. California Office of Statewide Health Planning and Development OSHPD; OPA-Preapproval of Anchorage; Code Application Notice CAN 2-1708A.5 and OSP-Special Seismic Certification Approval.
 - d. US Department of Homeland Security; FEMA- (installing seismic restraints for electrical equipment).

D. Wall Mounted Electrical Equipment

- 1. Surface Mounted Equipment
 - a. Provide multiple horizontal Sections of metal "C" channels for support and attaching wall mounted equipment to walls. Channels shall provide "turned lips" at longitudinal edges to hold "lock-in" fasteners and shall comply with ANSI-1008 and ASTM-A569 latest revision. The channels shall be steel hot dip zinc galvanized. As manufactured by Unistrut or Kindorf.
 - b. The "C" channels shall be positioned horizontally within 3-inches of the top and bottom of each, equipment Section cabinet and located behind

each Equipment Vertical Section. Provide additional intermediate “C” channels at not less than 36-inches on center between the “top” and “bottom” “C” channel positions, located behind each equipment vertical Section.

- c. The “C” channels shall be of sufficient length to provide connection to not less than two vertical structural wall framing elements separated by not less than 16-inches; but in no case shall the “C” channel length be less than the width of the respective equipment Section.
 - d. Attach the “C” channels to the wall structural elements after the wall, finish surface, installation (including painting) is complete.
 - e. Attach the “C” channels with fasteners to the building wall framing structural elements as follows: welded to steel framing; bolted to wood framing; cast in place concrete inserts for masonry and concrete construction; drilled “afterset” expansion anchors for existing masonry and concrete construction.
 - f. Attach the equipment to the “C” channels with threaded and bolted fasteners to “pre-locate” and lock into the channel “turned lips” and channel walls.
2. Flush mount equipment
 - a. Provide anchor attachment of equipment into adjacent wall structural elements.

E. Housekeeping Pad

1. Provide cast-in-place, steel re-enforced concrete raised “housekeeping” pads under all floor standing electrical equipment (except data network equipment racks).
2. Pad sizes
 - a. The raised housekeeping pad height shall extend 4-inches above the surrounding finished floor elevation for interior building locations.
 - b. The pad shall extend 8-inches below finish grade plus 4-inches above finish grade for outdoor equipment location on grade.
 - c. The pads shall extend 7-inches past the “footprint” edge of the respective floor standing equipment.
3. Anchor equipment to pads. Anchor pads to the building structural floor. Equipment pad, equipment re-enforcing and equipment anchoring shall comply with Seismic Earthquake Requirements and Wind Load Requirements.
4. Unless shown otherwise on Drawings. The equipment housekeeping pad steel re-enforcing shall consist of two layers of Number 4-size steel-rebar laid horizontally and uniformly spaced 6-inches on center. Position rebar in two directions (90-degrees opposed) and centered inside the concrete house-keeping pad. Horizontal rebar shall extend to within 3-inches of the edge of the concrete pad in all directions. Metal wire “tie-wrap” shall be provided at each rebar crossing.
5. Equipment anchor attachments shall extend through the housekeeping pad and into the structural concrete below the pad a minimum of not less than 2-inches.

1.18 ELECTRICAL WORK CLOSEOUT

- A. Prepare the following items and submit to the District’s Representative before final acceptance.
 1. Two copies of all test results as required under this Section.

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2. Two copies of local and/or State Code Enforcing Authority's Final Inspection Certificates.
 3. Copies of Record Drawings as required under the General Conditions, pertinent Division One Sections and Electrical General Provisions.
 4. Two copies of all receipts transferring portable or detachable parts to the District's Representative when requested.
 5. Notify the District's Representative in writing when installation is complete and that a final inspection of this work can be performed. In the event any defect or deficiencies are found during this final inspection they shall be corrected to the satisfaction of the District's Representative before final acceptance can be issued.
 6. List of spare fuses and locations identified by equipment name and building designation.
 7. Prior to energizing, retighten to the proper torque, each circuit conductor lug landing, each bus bar (phases, neutral and ground) and circuit protection device threaded connections in all switchboards, switchgear, motor control centers, transformers, bus-ways, disconnect switches, motor starters, motor terminals and panelboards, after the equipment is installed/connected and prior to energizing the equipment. The torque values shall comply with Manufacturer's recommendations.
- B. Electrical Power Single Line Diagrams – SLD
1. Provide single line diagrams showing the Contract Document work complete electrical power system (normal and emergency). SLD shall show inter-connection circuits, electrical equipment, panels, and circuit protection devices, nominal 50% (½-size) approximately 18-inches by 24-inches. Show installed voltages and electrical capacity sizes.
 2. SLD shall be mounted in metal (picture frame) rigid enclosure frame with rigid-backing (backer-board) and clear/transparent front, for hanging on wall. Provide clear trans-parent cover over SLD inside the frame.
 3. Provide a wall-hung (±48-inches) SLD in each "main" and "sub" electrical equipment room. If wall space is limited, alternatively securely attach SLD frame to room door facing into the respective electrical room.

END OF SECTION 26 0500
101320/223099

SECTION 26 0501

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
 - 2. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Submit product data sheets for all outlet boxes, wiring devices, device plates, relays, contactors, timeswitches, and disconnects fuses.
- B. Submit detailed Shop Drawings including Dimensioned Plans, elevations, details, schematic and point-to-point wiring diagrams, and descriptive literature for all component parts for transformers, relays, time clocks, and photocells.
- C. Submit Transformer Test Reports.
- D. Submit Material List for Outlet boxes.

PART 2 - PRODUCTS

2.01 OUTLET AND JUNCTION BOXES

- A. General:
 - 1. Flush or concealed outlet boxes and junction boxes.
 - a. Non-masonry and/or non-concrete locations provide pressed steel boxes. Steel thickness not less than 0.062-inch, hot-dip galvanized. Knockout (KO) type with conduit entrances and quantity size to match conduits shown connecting to respective junction box and outlet box.
 - b. UL-514 listed and labeled.
 - c. Minimum required box depth is exclusive of extension-ring depth.
 - d. Provide all boxes with matching cover plates. Cover plates shall be gasketed water-tight in wet and outdoor locations.
 - e. Boxes installed in masonry or concrete shall be UL "concrete-tight" approved for installation in concrete and shall allow the placing of conduit without displacing reinforcing bars.
 - 2. Provide boxes of proper Code size for the number of wires or conduits passing through or terminating therein. In no case shall box be less than 4.0-inches square by 2.125-inches deep, unless specified elsewhere or noted otherwise on the Drawings. 2.5-inches minimum depth for box width's exceeding 2-gang.

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3. Increase the minimum outlet box size to 4.69-inches square by not less than 2.125-inches deep, where one or more of the following conditions occurs:
 - a. More than two conduits connect to the outlet box.
 - b. Circuit or Conduit "homerun" connects to outlet box.
4. Signal, Communication and Low Voltage:
 - a. Individual audio/visual, telephone, computer, or data outlets: 4.69-inches square by 2.125-inch deep minimum with 2-gang extension ring on flush boxes.
 - b. Combination signal/telephone/data or computer outlets: 4.69-inches square by 2.125-inch deep minimum with 2-gang wide extension ring on flush boxes.
5. Junction boxes shall be sized to comply with the following:
 - a. Code Requirements size based on the conduit quantities, conduit sizes and wire-fill connected to the junction box.
 - b. Junction box minimum size shall not be less than 4.69-inches by 4.69-inches by 2.5-inches deep, but not less than size indicated on the Drawings or required by Code.
6. Provide extension rings on flush outlets to finish face of extension ring flush with finished building surfaces. Extension ring shall match outlet box construction and contain "attachment mounting-tabs" for wiring devices. Extension rings shall be "screw-attached" to respective outlet box and maintain "ground" bonding continuity.
7. Outlet boxes installed in outdoor locations, or in wet locations, or in concrete/masonry, shall be cast-iron or cast-bronze, with threaded conduit hubs. UL rated for wet locations.
 - a. Aluminum boxes shall NOT be in contact with concrete or masonry. Die-cast aluminum or cast aluminum water-tight electrical outlet boxes with threaded hubs may be provided as an alternate to cast-iron or cast-bronze outlet boxes, only where one or more of the following conditions occur:
 - 1) Outdoor locations above finish grade.
 - 2) Indoor wet locations surface or flush in walls or ceilings.
8. Provide fixture-supporting device in outlet boxes for surface mounted fixtures as required.
9. Provide solid gang boxes for three or more devices, typical for line and low voltage switches, receptacles, low voltage/signal outlets, etc. for mounting devices behind a common device plate.
10. Provide isolation barriers in outlet boxes:
 - a. Between line voltage and low voltage devices.
 - b. Where more than one device is installed in an outlet box.
 - c. Between 277-volt and 120-volt devices.
 - d. Between devices connected to emergency and non-emergency circuits of all voltages.
11. Outlet boxes installed penetrating into fire rated walls, fire rated floors, fire rated ceilings and all fire rated construction. The outlet boxes shall be UL listed, classified, and labeled, for fire rated and temperature rated penetration of the respective fire rated surface and fire rated construction. The outlet box fire rating and temperature rating shall equal or exceed the fire/temperature rating of the surface/construction being penetrated. Provide UL listed and labeled supplemental fire and temperature protection to maintain ratings:
 - a. Wall and ceiling penetrations, tumescent fire wrap (external or internal of outlet box).
 - b. Floors provide subfloor supplemental fireproofing below floor box.

12. Outdoor flush in wall device outlet boxes:
 - a. Flush in wall, gasketed watertight, with hinged, key locking cast metal, self-closing cover. Tamper resistant and vandal resistant. UL-listed and labeled for installation in masonry, cast-in-place concrete, and hollow-framed walls.
 - b. Flush cast-iron or cast-bronze device back-box, 4.68-inch square by 2.25-inch deep.
 - c. Internal metal adapter plate and wiring device types, in the box as indicated on the Drawings.
 - d. As manufactured by Legrand/Pass and Seymour #4600 Series: or C.W. Cole #310 Series.
13. Refer to Architectural and Structural Contract Documents and details for additional Box and Install Requirements.

B. Surface Outlet Boxes

1. Surface mounted outlet boxes cast iron Type FS or FD, with threaded hubs as required. Box interior dimensions and interior volume capacity not less than required for "press steel boxes", and "sheet steel boxes". Provide plugs in all unused openings. Provide weatherproof gaskets for all exterior boxes.

2.02 PULLBOXES

A. General

1. Sizes as indicated on the Drawings and in no case of less size or material thickness than required by the Governing Code and AHJ.
2. Exercise care in locating pull boxes to avoid installation in drain water flow areas and to clear existing condition interferences.
3. UL listed and labeled for electrical circuits.

B. General Purpose Sheet Metal Pullbox

1. General purpose sheet steel pull boxes: Install only in dry protected locations with removable screw covers. Manufacturer's standard rust proofing and baked enamel finishes.
2. Weatherproof sheet steel pullboxes: Fabricate of Code gauge steel. All surfaces interior and exterior hot-dip galvanized steel. Gasketed weather-tight cover of same material. Manufacturer's standard baked exterior enamel finish.

C. Concrete Pullboxes and Hand-holes

1. H-20 traffic rated box and cover, pre-cast concrete, steel reinforced pullboxes and hand-holes. Provide complete with pulling irons, hot-dip galvanized metal traffic cover with hot-dip galvanized metal cover frame, pullbox concrete base with sump. Four cable full height wall racks with porcelain blocks.
2. Boxes shall be "Intercept" type with multiple sections and extension cable-intercepts at both ends of box. Refer to Drawings for box size.
3. Covers shall be flush bolt down. Covers weighing more than 40-pounds shall be split cover type "Torsion-Spring" assist, hinged open-close.
4. Box covers shall comply with Federal ADA, UL, State and Local AHJ for slip resistance. Provide bead weld on cover to pullbox to indicate services within pullbox (i.e., "480/ 277-VOLT, 3-PHASE, 4-WIRE ELECTRICAL" OR "SIGNAL /TEL/P.A./CLOCK/FIRE ALARM" etc.).
5. Shall be set on a machine-compacted pea gravel base 12-inch thick and extend 6-inches beyond box base on all sides. Provide a ¾-inch by 10-feet

- copper clad ground rod through the box bottom with 9-inch projection into box, for grounding all metal parts with #10awg copper bond wire.
6. After cables have been pulled, connected, tested, and inspected, seal all box joints and seal box between cover and frame with a mastic compound similar to Parmagum or Duk-seal.
7. As manufactured by Jensen Precast, or Oldcastle Precast.

2.03 SWITCHES

A. General

1. Provide wiring device circuit switches totally enclosed, electrical insulating Bakelite or electrical insulating composition base, manual operator type with 277-volt 60Hz AC rating for full capacity contacts rated for incandescent lamp loads, fluorescent lamp loads and motor loads. Switch mounting-ears for screw attachment to outlet box. Switches shall be UL listed and labeled; conform to NEMA-WD1 and WD6.
2. Switch controlling (on-off) rated for all lighting loads and all non-lighting loads; switch ratings shall be 20-amp, unless indicated otherwise on Drawings.
3. Color as selected by District's Representative. Switches controlling circuits connected to emergency power shall be red.
4. All switches shall be of the same Manufacturer.
5. Where switches are mounted in multiple gang assembly and are operating at 277 volts and/or 277 volts and 120 volts or emergency/non-emergency and mounted in same outlet box, there shall be an insulating barrier installed between each switch.
6. Devices shall additionally be listed and labeled as UL-All Weather-Resistant for the following install locations:
 - a. Devices indicated on Drawings as Weather-Proof (W.P.).
 - b. Devices installed in outdoor locations
 - c. Installed in classified wet or damp area locations both indoor and outdoor.
7. Wiring devices shall be listed and labeled for connection of both "solid" and "stranded" copper circuit conductors.
8. Switches with ampere and voltage ratings different than described herein. The different rated switches shall have the same characteristics and performance as the respective described switches, except for differing ampere and voltage characteristics.

B. Switches Heavy Duty (Toggle – Type)

1. Single Pole Switches – 20-amp at 277V

<u>Manufacturer</u>	<u>Toggle Type</u>	<u>Lock Type</u>
Hubbell	#HBL1221	#HBL1221-L
Legrand/P&S	#20AC1	#20AC1-L
Leviton	#1221	#1221-L
Cooper-Arrow/Hart	#AH1221	#AH1221-L
2. Double Pole Switch – 20 amp at 277V

<u>Manufacturer</u>	<u>Toggle Type</u>	<u>Lock Type</u>
Hubbell	#HBL1222	#HBL1222-L
Legrand/P&S	#20AC2	#20AC2-L
Leviton	#1222	#1222-L
Cooper-Arrow/Hart	#AH1222	#AH1222-L

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3. Three-Way Switches – 20 amp at 277V

<u>Manufacturer</u>	<u>Toggle Type</u>	<u>Lock Type</u>
Hubbell	#HBL1223	#HBL1223
Legrand/P&S	#20AC3	#20AC3-L
Leviton	#1223	#1223-L
Cooper-Arrow/Hart	#AH1223	#AH1223-L
4. Four-Way Switches – 20 amp at 277V

<u>Manufacturer</u>	<u>Toggle Type</u>	<u>Lock Type</u>
Hubbell	#HBL1224	#HBL1224-L
Legrand/P&S	#20AC4	#20AC4-L
Leviton	#1224	#1224-L
Cooper-Arrow/Hart	#AH1224	#AH1224-L
5. Momentary Contact Switches – 20 amp at 277V

<u>Manufacturer</u>	<u>3-Position Regular</u>	<u>3-Position Lock</u>
Hubbell	#HBL1557	#HBL1557-L
Legrand/P&S	#1251	#1251-L
Leviton	#1251	#1251-L
Cooper-Arrow/Hart	#AH (extra)	#AH (extra)
6. Maintained Contact Switches (Double Throw, Center Off) – 20 amp at 277V

<u>Manufacturer</u>	<u>Toggle Type</u>		<u>Lock Type</u>	
	<u>1-Pole</u>	<u>2-Pole</u>	<u>1-Pole</u>	<u>2-Pole</u>
Legrand/P&S	#1225	#1226	#12250L	#1226-L
Hubbell	#HBL1385	#HBL1386-L	#HBL1385-L	#HBLM1386-L
Leviton	#1385	#1386		
Cooper-Arrow/Hart	#AH (extra)	#AH (extra)	#AH (extra)	#AH (extra)
7. Pilot lights used in conjunction with circuit switches shall be LED type with red jewel.

C. Weather-Proof (W.P.) Switches

1. Outdoor switches provide heavy-duty, tamper resistant gasketed weatherproof metal, hinged door cover for each switch.
2. Cover door shall be key locking-type or padlock-type.

D. Other Switches, Receptacles, Devices, and Outlets

1. Special devices outlets and outlet locations shall be as indicated on the Drawings. Modify device and outlet characteristics to accommodate the actual install location conditions for each outlet.

2.04 RECEPTACLES

A. General

1. All receptacle wiring devices in flush type outlet boxes shall be installed with a bonding jumper to connect the box to the receptacle ground terminal. Grounding through the receptacle mounting straps is not acceptable. The bonding jumper shall be sized in accordance with the branch circuit protective device as tabulated herein under "Grounding". Bonding jumper shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws 6-32 or larger (except isolated ground receptacles). For receptacles in surface mounted outlet boxes direct metal-to-metal contact between receptacle mounting strap (if it is connected to the grounding contacts) and outlet box may be used. Receptacle mounting-ears for screw attachment to outlet box. Receptacle shall be UL listed and labeled; conform to NEMA-WD1 and WD6.

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2. All receptacles shall be same Manufacturer.
 3. Receptacle color as selected by District's Representative. Receptacles connected to emergency power circuits shall be red.
 4. Tamper Resistant Receptacle
 - a. Devices shall additionally be listed and labeled as tamper resistant.
 - b. The electrical receptacles shall be rated "Tamper-Resistant-Receptacle" (TR), UL-TR (TRTR). Spring loaded shutters shall automatically open-close (unblock-block) the receptacle slots when the plug-in (cap) insertion and removal occurs.
 - c. Typical for 15-amp and 20-amp receptacles. Modify Manufacturer's catalog number description to include tamper resistant receptacle function.
 5. Wiring devices shall be listed and labeled for connection of both "solid" and "stranded" copper circuit conductors.
 6. Duplex convenience receptacles and 120-volt single phase branch circuits.
 - a. Duplex (convenience) receptacle, wiring device with two single receptacles with the same electrical rating, integrated into a single assembly by the Manufacturer.
 - b. 20-amp branch circuits with a single duplex convenience receptacle connection on each circuit, receptacles shall be rated for 20-amp.
 - c. 15-amp and 20-amp branch circuits with two or more duplex convenience receptacle connections each circuit, receptacle shall be rated 15-amp or 20-amp.
 7. Devices shall additionally be listed and labeled as UL-All Weather-Resistant, provide weather resistant receptacles for the following install locations:
 - a. Devices indicated on Drawings as Weather-Proof (W.P.).
 - b. Devices installed in outdoor locations.
 - c. Devices installed in classified as damp or wet locations both indoor and outdoor.
 - d. All GFCI (ground-fault) receptacles all locations.
 8. Receptacles with ampere and voltage ratings different than described for duplex convenience receptacles. The different rated receptacles shall have the same characteristics and performance as the respective duplex convenience receptacles, except for differing ampere and voltage characteristics.
 9. Receptacles shall be GFCI type for the following locations:
 - a. located within 84-inches of a sink or hosebib shall be GFCI receptacles.
 - b. Devices installed in outdoor locations.
 - c. Devices installed in classified as damp or wet locations both indoor and outdoor.
 - d. Devices indicated on Drawings as GFCI or Weather-Proof (W.P.).
- B. Duplex convenience receptacles.**
1. Shall be grounding type, 120 volt and shall have two current carrying contacts and one grounding contact which are internally connected to the frame. Outlet shall accommodate standard parallel blade cap and shall be side wired. Receptacles shall be Tamper Resistant-TR, UL-TR.
 2. GFCI receptacles shall be all Weather-Resistant and wet location rated. Rated 120-volt 60Hz AC, 20 amp, unless indicated otherwise on Drawings.
 3. Heavy Duty Industrial Grade

	<u>Manufacturer</u>	<u>NEMA 5-15R</u>	<u>NEMA 5-20R</u>	<u>NEMA 5-20R-GFCI</u>
a.	Legrand/P&S	#5262	#5362	#2095HG
b.	Leviton	#5262	#5362	#W7899
c.	Hubbell	#CR5252	#5362	#GFR8300

d. Cooper-Arrow/Hart #AH5262 #AH5362 #WRVGF20

C. Weatherproof (W.P.) Receptacle

1. Outdoor receptacles shall be duplex convenience GFCI type rated 20-amp 120 Volt 60Hz AC weatherproof, GFCI, unless indicated otherwise on Drawings. Test-reset buttons and visual pilot.
2. GFCI receptacles shall be wet location and Weather-Resistant rated weather-proof, gasketed, key locking tamper resistant, wet location.
3. Outdoor, flush mount outlet with hinged, key-locking, weather-proof cover (CEC/NEC – 406.8 compliant). As manufactured by Pass and Seymour/ Legrand #4600 Series; or C.W. Cole #310 Series.
4. On exposed conduit runs, provide weatherproof ground fault circuit interrupter type GFCI receptacles installed in "FS" conduit watertight cast metal body, with weatherproof spring door type covers, gasket watertight. Door shall be key locking-type or padlock-type.

D. Other Switches, Receptacles, Devices, and Outlets.

1. Special devices, outlets and outlet locations shall be as indicated on the Drawings. Modify device and outlet characteristics to accommodate the actual install location conditions for each outlet.

2.05 PLATES

A. Metal cover plates for devices

1. Provide cover plates for every switch, receptacle, telephone, computer, television, and other device outlets. All plates shall be 0.040-inch stainless steel, Type 302 alloy composed of 18% chromium and 8% nickel. Plates shall be manufactured by P&S, Hubbell, Leviton, or General Electric.

2.06 VANDAL-PROOF FASTENINGS

Provide approved vandal-proof type screws, bolts, nuts where exposed to sight throughout the project. Screws for such items as switch plates, receptacle plates, fixtures, communications equipment, fire alarm, blank covers, wall, and ceiling plates to be spanner head stainless steel, tamperproof type. Provide District with six screwdrivers for this type.

2.07 STRUCTURAL AND MISCELLANEOUS STEEL

Structural and miscellaneous steel used in connection with electrical work and located out-of-doors or in damp locations, shall be hot dip galvanized unless otherwise specified. Included are underground pullbox covers and similar electrical items. Galvanizing averages 2.0 ounce per square foot and conforms to ASTM A123.

2.08 FLASHING ASSEMBLIES

A. General

1. Flashing shall be compatible with the material being penetrated and with the pipe passing through the flashing. Coordinate with and comply with Manufacturer's recommendations, for both the flashing and the material being penetrated.
2. Provide lead metal flashing assemblies at all roof penetrations, unless recommended otherwise by Manufacturer.
3. Seal the joint between the flashing and pipe passing through the flashing with waterproofing compound.
4. Lead flashing for roof penetrations, as manufactured by Santa Rosa Lead Products; or Semco; or Flashco.

B. Storm Collars

1. In addition to penetration flashing, provide a storm-collar counterflashing for each roof penetration flashing. Shall attach to the structure of the penetration and form a water-tight "umbrella" counter flashing over the roof penetration flashing.
2. As manufactured by STD-Storm collars; or ASI-Storm collars.

2.09 RELAYS, CONTACTORS AND TIMESWITCHES

A. Individual Control Relays (HVAC Plumbing of the Control Functions)

1. Individual control relays shall have convertible contacts rated a minimum of 10 amp, 600 volts regardless of usage voltage. Coil voltage, number and type of contacts shall be verified and supplied to suit the specific usage as shown in the wiring diagrams and/or schedules on the Electrical and Mechanical Drawings. Coil control circuit shall be independently fused, sized to protect coil. Relays shall be installed on prefabricated mounting strips. Each relay shall have a surge suppressor to limit coil transient voltages. Furnished in the NEMA Type I enclosure unless indicated otherwise.

2. The following relays are approved:

<u>Manufacturer</u>	<u>Type</u>
Cooper-Arrow/Hart	IMP
General Electric	Class CR 2811
Square D Co.	Class 8501, Type A
Westinghouse	Bul. 16-321, Type NH
Allen Bradley	Approved Equal

B. Contactors and/or Relays

1. Contactors and/or relays for control of lighting shall be 600-volt AC, electrically operated, mechanically held units, open type for panel mounting with number of poles and of size as indicated on the Drawings. Provide auxiliary control relay for operation of each contactor and/or relay with a 2-wire control circuit.
2. Contactors and/or relays shall be mounted in panelboards in barriered section under separate hinged lockable doors or in contactor and/or relay cabinets as called for on the Drawings. Contactors and/or relays shall be installed on Lord sound absorbing rubber mounts.
3. Contactors and/or relays shall be Automatic Switch Co. Bulletin #920 Series for 2-pole and 3-pole, Automatic Switch Co. Bulletin 917 Series with poles as indicated on Drawings. Coil control circuit shall be independently fused, sized to protect coil.
4. Contactors and/or relays shall be equipped with a switch, in the proper configuration, to disconnect the control circuit controlling the coil of the respective device. Control circuit disconnect switch shall be labeled showing function of device.

C. Time-Switches

1. All time-switches shall have synchronous motor drive for operation on 120 or 277 volts, 60Hz, AC and shall be furnished with a 10-hour, spring-driven, reserve-power motor. Contacts shall be rated 40A per pole.
 - a. Exterior lighting time-switches for control of individual circuits or electrically operated relays shall have astronomic dial and shall be Tork 7000ZL Series or approved equal by Paragon or Intermatic.

- b. Interior lighting time-switches for control of individual circuits or electrically operated relays shall be Tork 7000 Series or approved equal by Paragon or Intermatic.
 - c. Time-switches for control of air conditioning or plumbing equipment shall have 7-day dial and shall be Tork WL Series or approved equal by Paragon or Intermatic.
 - 2. All time-switches shall be mounted in separate section in top of panelboards under separate lockable door unless otherwise indicated on Drawings. Clear opening for time-switch shall be a minimum of 12-inches by 12-inches.
- D. Contactors and/or Relays/Time-Switch Cabinet
 - 1. Contactors, relays, and/or time-switches not indicated to be mounted in electrical panels shall be mounted in a cabinet, size as required, with hinged lockable door keyed same as panelboards. Construction of cabinet shall be similar to terminal cabinets.
 - 2. Each contactor, relay or time-switch mounted in the contactor cabinet shall be barriered in its own compartment and shall be installed on Lord sound absorbing mounts.
 - 3. Contactor cabinets shall be of the same Manufacturer as the panelboards.
 - 4. Where relays and/or contactors occupy the same enclosure as time-switches they shall have a clear acrylic shield installed over each relay or contactor to guard line exposed parts from accidental contact by non-authorized personnel.

2.10 DISCONNECTS (SAFETY SWITCHES)

- A. General
 - 1. Disconnect switches shall all be rated:
 - a. 600-volt 60Hz AC for all safety switches.
 - b. NEMA Type HD, quick-make, quick-break, H.P.-rated.
 - c. Fused Class "R", in NEMA Type I enclosure, lockable.
 - d. Number of poles and amperage as indicated on the Drawings.
 - 2. Provide internal neutral bus, ground-lug and conductor landing lugs, size to match conductors shown on Drawings. Switch access door shall be interlocked with switch to prevent access inside switch when switch is "on" closed position.
 - 3. Where enclosure is indicated W.P. (Weather-Proof) switches shall be raintight NEMA Type HD and NEMA 3R enclosure, lockable.
 - 4. Maximum voltage, current and horsepower rating clearly marked on the switch enclosure and switches having dual element fuses shall have rating indicated on the nameplate.
 - 5. Switch and fuses ampere rating shall also comply with Manufacturer recommendation for the connected load.

2.11 CONCRETE WORK (ADDITIONAL REQUIREMENTS)

- A. Portland Cement
 - 1. ASTM C33- (latest revision), Type II, Low Alkali Cement. Composed of Portland cement, coarse aggregate, fine aggregate, and water.
 - a. Concrete for use as electrical equipment footings, lighting pole bases and equipment slabs on grade, concrete shall attain minimum 28-day compressive strength of 4000-psi, using not less than 5.75 sacks of cement per cubic yard of wet concrete.

- b. Concrete for underground duct/conduit encasement, the minimum 28-day compressive strength shall be 2000 psi. Provide a minimum of 10-pounds of red oxide concrete coloring per yard of concrete.
 - c. Mix shall obtain a 6-inches slump, measured with standard slump cone per ASTM C143/C143M (latest revision).
 - 2. Coarse Aggregate: Uniformly graded between maximum size not over 1½-inch and not less than ¾-inch and minimum Size #4, crushed rock, or washed gravel. For concrete encased conduit only, maximum aggregate size shall be ½-inch.
 - 3. Fine Aggregate: Clean, natural washed sand of hard and durable particles varying from fine to particles passing 3/8-inch screen, of which at least 12% shall pass fifty mesh screens.
- B. Water: Clean and free from deleterious quantities of acids, alkalis, salts, or organic materials.
- C. Reinforcement
 - 1. Bars: Intermediate Grade Steel conforming to ASTM A615/A615M grade 60, with pattern deformations.
 - 2. Welded Wire Fabric: ASTM A185/A185M.
 - 3. Bending: Conform to Requirements of ACI 318.
- D. Form Material: For exposed work, use PS 1-66 "B-B Concrete Form" plywood forms, or equal. Elsewhere, forms may be plywood, metal, or 1-inch by 6-inch boards. Forms for round lighting pole bases shall be sono-tube.

2.12 WIREWAY

- A. General:
 - 1. Unobstructed lay in type, metal wireway, fittings and connectors UL listed for use as wireway and auxiliary gutter. Length, elbows and "T-S" as shown on Drawings. Minimum cross-section size 4-inches by 4-inches, but not less than shown on the Drawings. Suitable for mounting in any position orientation.
- B. Construction:
 - 1. Minimum metal gauge shall not be less than 14-gage.
 - 2. Cover shall be hinged entire length of cover. Cover shall be held in the closed position with bolts and nuts.
 - 3. Provide spring nuts on all hardware fastener penetrations into the interior of the wire-way to protect against wire insulation damage.
 - 4. The inside of 90-degree corners in the wireway shall be a 45-degree bevel.
 - 5. Grounding continuity between wireway sections and fittings shall be continuous the entire length of the wireway.
- C. Finish:
 - 1. Indoor non-raintight, rust inhibitor phosphatizing base coating and baked enamel finish, Manufacturer's standard color.
 - 2. Raintight outdoor-galvanized metal, with corrosion resistant phosphate primer and baked enamel finish, Manufacturer's standard color, NEMA 3R construction.
 - 3. All hardware shall be plated to prevent corrosion.

PART 3 - EXECUTION

3.01 GROUNDING (ADDITIONAL REQUIREMENTS)

- A. Grounding shall be executed in accordance with all applicable Codes and Regulations, both of the State of California and Local Authorities Having Jurisdiction.
- B. Each pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.
- C. The Maximum Resistance to Ground shall Not Exceed 5 ohms.

3.02 OUTLET AND JUNCTION BOXES

- A. General:
 - 1. Accurately place boxes and securely fastens to structural members. Where outlets are shown at same location but at different mounting heights, install outlets in one vertical line. Where outlets are shown at same location and mounting height, mount outlets as close together in a horizontal row as possible. Where the outlet boxes for switches and receptacles are shown at the same location and mounting height, mount in common out-let box with barriers between devices. Provide single piece multi-gang cover plate for close mounted outlet boxes. Where switches are shown on wall adjacent to hinge side of doors, box shall be installed to clear door when door is fully opened.
 - 2. Flush mounted boxes shall be attached to not less than two parallel studs or structure members by means of metal supports. The supports shall span between and attach to the structure members.
 - 3. Boxes above accessible ceilings shall be attached to structural members. Where boxes are suspended, they shall be supported independently of conduit system by means of hanger rods and/or preformed steel channels. Boxes shall be supported independently of all piping, ductwork, equipment, ceiling hanger wires and suspended ceiling grid system.
 - 4. Surface mounted outlets shall be attached to concrete or masonry walls by means of expansion shields.
 - 5. Outlet Box Horizontal and Vertical Separation: Outlet boxes and device outlet rings installed flush in walls shall be horizontally and vertically separated by not less than 24-inches (edge of box to edge of box) from device outlet boxes and rings in common wall surfaces located on the opposite (back) side of the same wall.
 - a. Where the separation cannot be maintained, provide a solid backing behind and completely enclosing each outlet box.
 - b. The backing shall extend the width of the wall cavity (i.e., between "studs" or masonry cells) behind the box and 12-inches above and below the outlet box centerline, completely enclosing the outlet box.
 - c. The backing shall consist of the following:
 - 1) 5/8-inch thick gypsum board anchored in place for "stud" wall construction.
 - 2) Solid "mortar" to completely fill the outlet box "cell" behind the box in masonry construction.
 - 6. Provide metal outlet box for each device. Install devices in metal outlet boxes. Typical for all wiring devices including, switches, receptacles, line voltage devices, and low voltage/signal system devices.

- B. Fire Wrap:
 - 1. In fire rated walls and ceilings provide fire rated "box-wrap" around the outside of each outlet box placed in fire rated wall or ceiling. Install the fire wrap on exterior of box in-side the wall or ceiling, to maintain the fire rating of wall or ceiling with the installed out-let boxes.

3.03 SWITCHES AND RECEPTACLES-DEVICES

- A. General
 - 1. Provide outlet boxes for all devices, switches, receptacles, both line-voltage and low-voltage.
 - 2. Devices installed in wireways shall be installed flush in wireway assembly.
 - 3. Install and screw attach devices into outlet boxes and wireways.
 - 4. Provide ground circuit connections to all devices.
 - 5. Provide branch circuit connections to all devices.
 - 6. Provide testing and commissioning for proper operation and phase/ground connectors.
 - a. Test each GFCI devices after installation and circuit connection is complete.
 - b. Test all devices for correct polarity and proper electrical energization.
 - 7. Install and adjust all coverplates to be flush and level, with correct device identification.
 - 8. Were one or more devices occur at the proximity with other similar devices, all of the devices shall be "granged" under one common coverplate as follows:
 - a. Duplex convenience receptacles with other proximity (within 18-inches) duplex convenience receptacles.
 - b. Lighting control switches not exceeding 20-amp switch rating with other proximity (within 18-inches) similar switches.
- B. Line-Voltage Plug-In Type Receptacle Installation Orientation:
 - 1. The "ground-pin" shall face "up" at the receptacle top location (double duplex) 4-plex, individual and vertically mounted individual duplex receptacles.
 - 2. The "neutral-blade" shall face "up" at the receptacle top location on horizontally mounted duplex receptacles.

3.04 CONCRETE WORK

- A. Form:
 - 1. Space forms properly with spreaders and securely tie together. Do not use twisted wire form ties. Keep forms wet to prevent joints from opening up before concrete is placed. Replace improper construction as directed. Do not use wood inside forms.
 - 2. Build in and set all anchors, dowels, bolts, sleeves, iron frames, expansion joints and other materials required for the Electrical Work. Place all items carefully, true, straight, plumb, and even.
 - 3. Carefully remove all exposed forms. Cut nails and tie wires below face of concrete and fill all holes. Rubbish will not be allowed to remain in, under, or around concrete.
- B. Mixing: Use batch machine mixer of approved type. After ingredients are in mixer, mix for at least 1½-minutes.

- C. Transit Mixing: In lieu of mixing at site, transit mixing may be used if rate of delivery, haul time, mixing time, and hopper capacity is such that concrete delivered will be placed in forms within 90-minutes from time of introduction of cement and water to mixer.
- D. Placing of Concrete
 - 1. Before placing concrete, remove wood, rubbish, vegetable matter and loose material from inside forms. Thoroughly wet down wood forms to close joints.
 - 2. Clean reinforcement; remove paint, loose rust, scale, and foreign material. Bars with bends not called for will be rejected. Hold securely in place to prevent displacement. Lap bar splices 24-diameters, min; lap fabric one mesh min. Tie intersections, corners, splices with 16-gallon annealed wire, or as otherwise called for.
 - 3. Place concrete immediately after mixing. Do not use concrete that has begun to set; no tempering will be allowed. If chuting is used, avoid segregation. In placing new concrete against existing concrete, use bonding agent per Manufacturer's directions.
 - 4. Give careful and thorough attention to curing of concrete. Keep concrete and forms wet for a minimum of 10-days, after placing concrete.
- E. Concrete Finish
 - 1. Finish of Exposed Concrete: Horizontal surfaces, steel troweled monolithic finish; vertical surfaces, smooth and free of fins, holes, projection, etc.
 - 2. Exposed lighting pole bases shall be filled, and sack finished to a smooth finish.

3.05 WIREWAY INSTALLATION

Wireway hangers shall provide clamp type, hanger rod type, direct bolted bracket type from ceiling or walls as indicated on the Drawings and required for field installation locations. Supports shall be installed a minimum of 5-feet on center.

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SECTION 26 0530

CONDUIT AND WIRE

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
 - 2. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Submit product data sheets for all wire, supports, conduit, fittings, and splicing materials.
- B. Submit material list for all conduit and conduit fittings.
- C. Submit Details and Structural Engineering calculations for conduit support systems.

PART 2 - PRODUCTS

2.01 CONDUIT

- A. General
 - 1. The interior surfaces of conduits and fittings shall be continuous and smooth, with a constant interior diameter. Conduits and conduit fittings shall provide conductor raceways of fully enclosed Circular Cross Section. The interior surfaces of conduits and fittings shall be without ridges, burrs irregularities or obstructions. Conduits and fittings of the same type shall be of the same uniform weight and thickness.
 - 2. Type of conduit, type of conduit fittings and conduit supports shall be suitable for the conditions of use and the conditions of location of installation, based on the Manufacturer's recommendations and based on applicable Codes.
 - 3. All fittings for metal conduit shall be suitable for use as a grounding means, pursuant to the applicable Code Requirements. All metal conduit and metal conduit fittings shall provide 3 second duration ground fault current carrying ratings, when installed and connected to the respective conduit, as follows:
 - a. RMC and EMT conduit fittings.
 - 1) 0.5 inch through 1.5-inch conduit/fitting size - 10,000-amp RMS.
 - 2) 2.0 inch and larger conduit/fitting size - 20,000-amp RMS.
 - b. FMC and LTFMC Conduit Fittings
 - 1) 0.5 inch through 1.25-inch conduit/fitting size-1,000-amp RMS (without external bonding jumper).
 - 2) 1.5 inch through 4.0-inch fitting size-10,000-amp RMS with bonding jumper.

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4. Protective corrosion resistant finish for metal conduit fabricated from steel and metal conduit fittings fabricated from steel, shall be as follows:
 - a. Clean all metal surfaces (including metal threads) with acid bath "pickle" prior to coating, to remove dirt, oil and prepare surfaces for galvanizing.
 - b. Hot-dip galvanized zinc coating on all interior and exterior steel surfaces. Minimum finish zinc coating thickness shall not be less than 0.002 inches.
 - c. Threads shall be hot-dip zinc coated after machine fabrication.
 - d. Exterior metal surfaces shall be finished with clear organic polymer topcoat layer, after galvanizing.
 - e. The inner metal surfaces of conduit fittings shall be finished with a lubricating topcoat after galvanizing, to facilitate conductor pulling through the conduit/fitting.
 5. Threads for metal conduit and metal conduit fittings shall be taper-pipe-thread, National Pipe Standards (NPS) and shall comply with ANSI-B1.20.1.
 6. Metal conduit termination connector fittings shall be provided with a Manufacturer installed, insulating throat bushing inside the fitting. The bushing shall protect the wire conductor insulation from cutting, nicks and abrasion during conductor installation and electrical load "cycling" after installation is complete. The bushing shall comply with UL 94V-0 flammability.
 7. Provide conduit bonding/grounding jumper from metal enclosures with "concentric ring" knockouts, to positively ground/bond each respective conduit(s) to the metal enclosure.
 8. Metal conduit fittings connecting to PVC coated metal conduit shall be PVC coated to match the conduit.
 9. The conduit and fittings shall be watertight and airtight without cracks and pin-holes.
- B. Rigid Metal Conduit (RMC)
1. Rigid metal, round tubing, machine threaded at both ends.
 - a. The conduit and conduit fittings shall comply with the Requirements for an equipment grounding conductor, pursuant to applicable Codes.
 2. RMC raceway types shall be as follows:
 - a. Rigid Galvanized Steel conduit (RGS), minimum yield strength shall be 35,000 PSI. Shall comply with NEMA Standard 5-19 (latest revision); ANSI C80.1 and ANSI-C80.4 (latest revision); UL 514-B and UL 6 (latest revisions); National Pipe Standard Specification (latest revision).
 - b. Intermediate Steel Conduit (IMC). Shall comply with NEMA Standard 5-19 (latest revision) ANSI-C80.6 (latest revision); UL 2142 (latest revision).
 3. RMC fittings:
 - a. Fittings shall be compatible with RGS and IMC.
 - b. Fittings shall be rated "liquid tight".
 - c. Fittings imbedded in concrete shall be rated "liquid tight" and "concrete tight".
 - d. Connectors and couplings for terminating, connecting, and coupling to RMC conduit shall be threaded metal.
 - e. Fittings shall comply with ANSI C80.4 and ANSI C33-84 (latest revision); NEMA FB1 (latest revision); UL 514 (latest revision).
 - f. Conduit seal fittings:
 - 1) Conduit seals shall prevent the passage of gasses, liquids, and vapors past the location of the seal installation in the conduit.
 - 2) Conduit seals shall be suitable for installation in both vertical and horizontal conduit locations.

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- 3) Conduit seals shall be visible and accessible for inspection after installation is complete.
 - 4) Conduit seals shall be rated for the following locations:
 - a) Wet locations
 - b) Classified hazardous location materials NEC Class 1 Division 1.
 - c) Temperature ranges from 0 minus 20 degrees centigrade through 90 degrees centigrade.
 - 5) Conduit seals, sealing compound and sealing compound dam shall be the products of the same Manufacturer.
4. RMC fittings as manufactured by:
- a. For threaded enclosure, termination connection.
 - 1) Thomas & Betts - 106 Series bonding locknut, 5302 Series sealing ring with stainless steel retainer.
 - b. For non-threaded enclosure, termination connector.
 - 1) Thomas & Betts - 370 Series watertight threaded sealing hub, 106 Series threaded bonding lock nut, Sta-Con Series enclosure bonding jumper and 3870 Series threaded ground bushing.
 - 2) Emerson-OZ/Gedney-CHMT/CHT watertight threaded hub with bonding locknut and GH50G Series enclosure bonding jumper.
 - c. For RMC to RMC conduit-to-conduit coupling
 - 1) Thomas & Betts/Erickson - 674 (threaded) Series
 - 2) Emerson-OZ/Gedney Type TPC (threaded) Series
 - 3) Threaded RMC conduit couplings, product of the same Manufacturer as the RMC conduit.
 - d. For RMC Conduit Seals
 - 1) Emerson-OZ/Gedney-EYA and EYAM (threaded) Series
 - 2) Appleton-EYF and EYM (threaded) Series
- C. Electrical Metallic Tubing (EMT)
1. Rigid metal round tubing, "thin wall" steel construction, with non-threaded ends.
 - a. The conduit and conduit fittings shall comply with the Requirements for an equipment grounding conductor pursuant to applicable Codes.
 - b. The conduit shall be watertight and airtight without cracks and pinholes.
 2. EMT shall be allowed for conduit size ranges from 0.5-inch through 4.0-inches.
 3. Comply with ANSI C80.3, C80.4, and ANSI C33.98 (latest revisions); UL 594 and UL 797 (latest revisions); CEC Section 12500 (latest revision).
 4. EMT fittings:
 - a. Connectors and couplings for terminating, connecting, and coupling to EMT conduit shall be non-threaded steel fabrication.
 - b. EMT termination connector fittings shall be as follows:
 - 1) Set screw type "concrete tight" when installed in dry interior locations.
 - 2) Compression types "raintight" and "concrete tight" when installed in wet or damp locations, outdoors and in concrete or masonry construction.
 - c. Fittings shall comply with ANSI C33.84 (latest revision); UL 514 (latest revision); NEMA FB-1.
 5. EMT fittings as manufactured by:
 - a. For threaded and non-threaded enclosure, termination connector
 - 1) Thomas & Betts-TC721A (set screw type) Series (with locknuts).
 - 2) Emerson-OZ/Gedney-TC500I (set screw type) Series (with locknuts).
 - 3) Thomas & Betts-5123 (compression type) Series (with 2 locknuts).

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- 4) Emerson-OZ/Gedney-TC600I (compression type) Series (with locknut).
 - 5) Thomas & Betts-4240 (compression type) Series (90-degree angle with locknut).
 - 6) Emerson-OZ/Gedney-TWL (compression type) Series (90-degree angle with locknut).
 - b. For EMT to EMT conduit-to-conduit coupling:
 - 1) Thomas & Betts-TK121A (set screw type) Series (with locknut).
 - 2) Emerson-OZ/Gedney-5000 (set screw type) Series (with locknut).
 - 3) Thomas & Betts-5120 (compression type) Series.
 - 4) Emerson-OZ/Gedney-TC600 (compression type) Series.
 - c. For EMT to RMC conduit to conduit combination coupling:
 - 1) Thomas & Betts-HT221 (set screw type) Series.
 - 2) Emerson-OZ/Gedney-ESR (set screw type) Series.
 - 3) Thomas & Betts-530 (compression type) Series.
 - 4) Emerson-OZ/Gedney-ETR (compression type) Series.
- D. Flexible Metal Conduit (FMC)
 1. Round flexible conduit fabricated from a single continuous steel strip. The steel shall be factory formed into continuous interlocking convolutions to form a complete lock between steel strips and provide raceway flexibility.
 2. Metal to metal grounding contact shall be maintained throughout the length of the FMC conduit.
 3. FMC shall be allowed for conduit size ranges from 0.5 inch through 4.0-inches.
 4. FMC shall comply with ANSI-C.33.84 and ANSI C33.92; NEMA FB-1; CEC 12-1100.
 5. FMC Fittings
 - a. FMC fittings shall be malleable iron construction or steel construction.
 - b. Fitting shall automatically cause the FMC raceway throat opening to be centered with respect to the fitting throat opening.
 - c. Straight and angled connector termination fittings shall be threaded on one end and shall include a threaded locknut, suitable for connection to threaded and unthreaded enclosures.
 - d. The attachment of the fittings to FMC shall be angled saddle type, to engage and interlock with the FMC spiral groove, and shall be unaffected by vibration. Direct bearing screw type fittings shall not be used.
 - e. Direct FMC conduit-to-FMC conduit coupling of FMC shall not be permitted.
 - f. Shall comply with ANSI C33.9, and ANSI C33.92 (latest revision); NEMA FB1 (latest revision); UL 514.
 6. FMC fittings as manufactured by:
 - a. Straight Termination Connectors 45 and 90 Degree Angle Connectors
Thomas & Betts-3110 Series Thomas & Betts-3130 Series
(with locknut) (with locknut)
 - b. FMC to EMT conduit combination coupling: Thomas & Betts 503TB Series.
- E. Liquid Tight Flexible Metal Conduit (LTFMC)
 1. The metal conduit core of LTFMC shall comply with the same Requirements as FMC conduit, with the addition of a thermoplastic exterior flexible jacket over the metal core.
 2. The exterior jacket shall be positively locked to the metal core to prevent jacket "sleeving".

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3. The LTFMC shall be rated for installation and operating service temperatures of between minus 20 degrees centigrade through plus 90 degrees centigrade.
 4. The LTFMC jacket shall be suitable for continuous exposure to sunlight, rainwater, water vapor, mineral oils, and liquid solvents, without penetrating into the conduit and without deteriorating the jacket.
 5. LTFMC sizes from 0.5-inch through 1.25-inch shall include an additional internal ground conductor, fabricated by the Manufacturer, as an integral part of the conduit core.
 6. Direct LTFMC conduit-to-LTFMC conduit coupling of LTFMC shall not be permitted.
 7. LTFMC shall be allowed for conduit size ranges from 0.5-inch through 4.0-inches.
 8. In addition to the Requirements for FMC conduit, LTFMC shall also comply with ANSI C-33.84 (latest revision); NEMA-FB1 (latest revision); CEC 12-1400 (latest revision).
 9. LTFMC fittings
 - a. Fittings shall include an external mechanical ground/bond wire connector.
 - b. The attachment of the fitting to LTFMC shall be threaded compression type onto the conduit core with locknut and liquid tight jacket compression seal. The fitting shall automatically prevent "sleeving" of the jacket.
 - c. Straight and angled termination connector fittings shall be threaded on one end and shall include locknut suitable for connection to threaded and unthreaded enclosures.
 10. LTFMC fittings as manufactured by:
 - a. Termination connector fittings:
 - 1) Straight
Thomas & Betts-5331 GR Series
45 & 90 Degree Angle Connectors
Thomas & Betts-5341GR & 5351GR Series.
Straight
 - 2) Appleton-STB & STN-L Series for use with performed "knockouts".
45 & 90 Degree Angle Connectors
Appleton-STB-L Series; STN-L Series for use with preformed "knockouts".
Straight
 - 3) Emerson- OZ/Gedney-4Q Series.
45 & 90 Degree Angle Connectors
Emerson-OZ/Gedney-4Q Series
 - b. LTFMC to RMC conduit to conduit combination coupling fittings:
 - 1) Thomas & Betts-5271 GR Series.
 - 2) Emerson-OZ/Gedney-4Q Series
- F. Rigid Non-Metallic Conduit (RNMC)
1. General
 - a. Conduit and fittings shall be 90-degree centigrade conductor rated. Fabricated from homogeneous material, free from visible cracks, holes, or foreign inclusions, with integral "end-bell". The conduit and conduit fittings shall be watertight and airtight.
 - b. Conduit, conduit fittings and conduit fitting assembly "solvent cement" shall all be the product of the same Manufacturer. Conduit fittings shall be solvent cement welded watertight.
 - c. Conduit and fittings shall be identified with legible markings showing ratings, size, and Manufacturers name.

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- d. RNMC and fitting shall be corrosion resistant, watertight.
 - e. Conduit shall be suitable for conductor operating temperatures from minus 20 degrees centigrade to 90 degrees centigrade.
 - f. RNMC shall comply with NEMA TC-2 (PVC 40 conduit, latest revision) NEMA TC-6 (EB conduit latest revision) and NEMA TC-3 (fittings, latest revision); UL 514 and UL 651 (latest revision).
 2. Polyvinyl Chloride (PVC)-RNMC
 - a. PVC-Schedule 40 heavy wall construction.
 - b. PVC-Schedule 80 extra heavy wall construction.
 - c. PVC-Type EB.
 3. RNMC fittings connecting to metallic raceways shall be provided with a ground/bond jumper connection.
- G. Combi-Duct
1. Rigid nonmetallic conduit combining a continuous linear outer raceway (duct) with factory installed (inside the outer duct) multiple, segregated inner raceway (ducts). Rigid, Schedule 40 PVC construction. Shall be modular lengths of 20-feet for each duct segment.
 2. The conduit shall be suitable for use with signal/telecommunications, fiber optic, telephone, and computer/data circuits, operating at 100 volts or less, UL listed and labeled.
 3. Outer Duct, outer enclosing Schedule-40 PVC duct size. The outer enclosing duct shall be 4.2-inches inside nominal duct diameter and 4.5-inches outer duct nominal diameter.
 4. Inner-ducts (contained inside the enclosing outer duct), non-metallic SDR-19 or Type-C/CAO-8546:
 - Triple Combi-Duct
 - a. Quantity of three continuous round rigid inner linear ducts, nominal size inside diameter 1.5-inch for each inner duct.
 - Quad Combi-Duct
 - b. Quantity of four continuous round rigid inner linear ducts, nominal size inside diameter 1.19-inch for each inner duct.
 5. Manufacturer's standard bends and offsets, minimum 72-inches radius.
 6. Combi-duct and combi-duct fittings shall be airtight and watertight. Approved for direct burial in earth and approved for encasement in concrete.
 7. As manufactured by Carlon # Multi-Guard/Multi-Cell Series; American Pipe and Plastic (AMTEL) #Multi-Bore Series; or equal.
- H. Expansion Joint, Deflection Joint and Seismic Joint Conduit Fittings
1. Expansion Conduit Fitting - Fitting shall provide for a minimum of 2-inches straight line movement between two connecting conduits in each direction (total 4-inches conduit expansion and Contraction) parallel to the respective conduit lengths. Fitting shall be watertight.
 2. Deflection Conduit Fitting - Fitting shall provide for a minimum of 30 degrees angular deflection movement ("Shear" deflection) between two connecting conduits, in any direction perpendicular to the length of the respective conduits. Fitting shall be watertight.
 3. Combination Expansion/Deflection Conduit Fitting - Fitting shall provide the combined "expansion" and "deflection" movement capacity between two connecting conduits as described for separate "expansion" and "Deflection" conduit fittings. Fitting shall be approved for installation concealed in both masonry/concrete construction and exposed non-masonry/concrete construction. Fitting shall be watertight.

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4. Fittings shall comply with UL.
5. Fittings as manufactured by:
 - a. Conduit expansion fittings exposed, or concealed locations as manufactured by:
 - 1) Emerson-OZ/Gedney – AXB-8 Series for RMC conduit.
 - 2) Emerson-OZ/Gedney - TX Series for EMT conduit.
 - 3) Appleton – AXB or XJ8 Series for RMC conduit and EMT conduits. Provide RMC to EMT combination conduit coupling fittings for each end of the expansion fitting.
 - b. Combination expansion/deflection conduit fittings exposed, or concealed conduit locations as manufactured by:
 - 1) Emerson-OZ/Gedney - AXDX Series for RMC conduit.
 - 2) Emerson-OZ/Gedney - AXDX Series for EMT conduit.
 - 3) Appleton-DX Series for RMC conduit.
 - 4) Provide RMC to EMT combination conduit coupling fittings for each end of the expansion/deflection fitting.
 - c. Conduit expansion/deflection fittings for FMC and LTFMC conduit.
 - 1) Provide a minimum of 12-inches of “slack” LTFMC in each FMC or LTFMC conduit at building and structure seismic or expansion joint conduit crossings.
 - 2) Note: Each FMC “slack” expansion/deflection location, shall be considered as not less than a 90-degree conduit bend location, for compliance with the maximum quantity of conduit bends allowed in a raceway.
6. Conduit fitting bonding jumper:
 - a. The grounding/bonding path of metal conduit shall be maintained by the fitting.
 - b. Provide a bonding jumper at each expansion, deflection, and combination expansion deflection conduit fitting.
 - c. The jumper shall be a bare flexible copper “braid”. The copper braid electrical current carrying capacity shall be equal to the metal conduit.
 - d. Provide a factory terminated ground clamp on each end of the braid with adjusting steel conduit grounding clamps and connect to each respective conduit end.
 - e. The jumper braid length shall be 8-inches longer than the respective conduit fitting.
 - f. Bonding jumper for FMC and EMT fittings as manufactured by:
 - 1) Emerson-OZ/Gedney – BJ and BJE Series
 - 2) Appleton – BJ/XJ Series
- I. Conduit Bodies Conduit Fitting
 1. Conduit bodies shall provide conductor access with a removable conduit body cover and wiring area enclosed in metal housing. The conduit body shall facilitate pulling conductors.
 2. In-line form “C” conduit bodies shall be prohibited.
 3. The interior space “length” of 90 degree “elbow” conduit bodies shall not be less than six times the diameter size of the largest conduit connecting to the conduit body.
 4. Conduit body covers shall be removable, gasketed; watertight “domed” metal covers “Mogul-Type” with threaded screw attachment to the conduit body.
 5. Lubricated, reusable, wire roller guards inside the conduit body shall protect wire from insulation damage during wire “pulling”.
 6. Conduit body fittings shall comply with UL 514.

7. Conduit bodies as manufactured by:
 - a. For RMC Conduit
 - 1) Hubbell/Killark – LB/Mogul (90-degree elbow) Series – threaded body.
 - 2) Emerson-OZ/Gedney - LB 6X/Mogul (90-degree elbow) Series - threaded body.
 - 3) Appleton – NEC6X-LB/Mogul (90-degree elbow) Series - threaded body.
 - b. For EMT Conduit
 - 1) Same as for RMC conduit. Provide EMT to RMC conduit combination coupling fitting for each outlet body connection.

2.02 PVC COATING

- A. PVC Coatings shall be provided as described for specified metal products.
- B. PVC Coating shall be factory applied, to comply with NEMA-RN1 and 5-19.
- C. The adhesion of the PVC coating to the coated metal shall exceed the strength of the coating itself, based on 0.5-inch “strip-pull” test.
- D. Uniform coating thickness shall be continuous without “breaks” or “pinholes” and shall not be less than the following:
 1. Exterior metal surfaces, 40-millimeter coating thickness.
 2. Interior metal surfaces, 10-millimeter PVC or urethane coating thickness (i.e. interior of conduits, interior of conduit fittings etc.).

2.03 CONDUIT SUPPORTS

- A. General
 1. Conduit Supports, hangers and fasteners for metal conduit shall be steel, hot dip zinc galvanized.
 2. Conduit supports, hangers and fasteners for PVC coated conduit shall be PVC coated to match the conduit PVC coating.
 3. Threaded hardware shall be continuous, free running threads.
 4. Conduit support systems, including support channels, pipe clamps, braces, anchors, hardware, fasteners, shall be sized to support the full capacity circuit conductors weight, plus the installed conduit weight, plus the conduit fitting weight and support hardware weight, plus a 300% additional weight capacity safety factor.
 5. Provide lock washer at each “bolted”/threaded connection.
 6. Conduit supports, fasteners, channels, braces, hardware, anchors, pipe clamps, and hangers as manufactured by Unistrut or Kindorf.
 7. Supports shall be free of “BURRS” and sharp edges.
 8. Metal supports cut in the field shall be zinc galvanized after cutting to prevent rust.
- B. Conduit Hangers
 1. Threaded steel hanger rods.
 - a. Hanger rods smaller than 0.375-inches in diameter shall not be used for support of individual conduits.
 - b. Hanger rods smaller than 0.5-inches in diameter shall not be used for support of multiple conduits.
 2. Conduit hanger wires shall be not less than 12-gauge steel.

3. Conduit hangers shall attach to structure fasteners with steel “Clevis” or “Swing” hangers and shall provide a minimum of 45 degrees of angular movement in any direction at the point of the conduit hanger attachment to the structure fasteners.
 4. Conduits individually suspended by conduit hangers shall fasten to the respective hangers with “Clevis” type pipe hangers. The pipe hangers shall be steel, adjustable to fit conduit size and shall completely enclose the conduit circumference.
- C. Conduit Support Channels
1. “C” channels shall be factory preformed with a minimum 12-gauge thickness metal. The channel shall be factory “punched” with regularly spaced slotted holes for fastener attachments along the length of the channel.
 2. The “C” channel shall not deflect more than 0.1 inch between channel supports at maximum installed design load, including required safety factor.
 3. Channels shall comply with ANSI-1008 (latest revision) and ASTM-A569 latest revision).
 4. Channels shall provide “turned lips” at longitudinal edges to hold (lock-in) fasteners.
 5. Conduit support channels suspended from conduit hangers shall attach to conduit hangers with treaded connections. Provide a minimum of two hangers (trapeze style) connected to each channel.
 6. Non-suspended conduit support channels shall connect to structure fasteners with threaded connectors.
- D. Fasteners, Seismic Earthquake Rated
1. Channel fasteners:
 - a. Channel fasteners shall “prelocate” and lock into the channel “turned lips” and channel “walls”.
 - b. A separate metal strap shall “tie” each conduit to each channel with conduit channel fasteners.
 2. Structure fasteners:
 - a. Structure fasteners for wall and floor mounted conduit attachments shall attach to existing masonry and concrete structures with structure fasteners using drilled, mechanical, expansion shield anchors.
 - b. Structure fasteners for wall and floor mounted conduit attachments shall attach to new masonry and concrete structures with structure fasteners using steel threaded inserts precast into the structures.
 - c. Structure fasteners shall center the support load above or below the beam flanges and reduce torsion-rotation forces exerted on the structural beam. Attach to steel structural members with “swing-beam clamps”, with set-locking screw structure fasteners.
 - 1) Beam clamps shall include integral safety rod, strap, or “J”-hook to secure the attachment clamp to the beam flanges on both sides of the beam, with integral hanger rod attachment.
 - 2) Or double-ended beam clamp to secure the attachment clamp to the beam flanges on both sides of the beam, with integral hanger rod attachment.
 - d. Structure fasteners for wall and floor mounted conduit attachments shall attach to wood structural members with flush “through-bolted” wood beam / wood framing stud structure fasteners.

- e. Structure fasteners for wall mounted conduit attachments shall attach to steel framing studs and steel structural elements with spot welded steel structure fasteners or drilled and bolted structure fasteners.
- E. Brace Connectors
 - 1. Provide lateral brace connectors to resist horizontal, lateral, and vertical movement of suspended conduits during seismic earthquakes.
 - 2. The braces shall connect from each conduit support, attach as close to the conduit as possible, and attach to fixed rigid, non-suspended building "main" structural elements with fixed anchoring.
 - 3. Brace attachment connectors and fasteners shall be rigid preformed steel channels or flexible #10-gauge steel hanger wire.
 - 4. Connect and attach the brace connectors to fixed structural elements in the same manner as conduit support hangers. The connection of braces to structural elements shall be independent of the conduit support hanger structure fasteners.

2.04 ELECTRICAL POWER WIRE AND CABLE

- A. General
 - 1. All wire and cable shall be single-conductor, annealed copper, insulated 600-volt, #12AWG minimum unless specifically noted otherwise on the Drawings.
 - 2. Conductors #10AWG and smaller shall be solid. Conductors #8AWG and larger shall be stranded.
 - 3. Insulation of conductor connected to circuit protection devices required to be "100%" rated, shall be 90-degree centigrade rated insulation.
 - 4. Insulation of conductors installed outdoors, on grade or underground, insulation shall be rated for wet locations.
 - 5. Insulation of conductors installed outdoors, installed exposed to the sun, installed in exposed conduits, insulation shall be rated for high-temperature 90 degrees centigrade.
 - 6. Insulation of branch circuit conducts installed in light fixtures; insulation shall be rated for 90 degrees centigrade.
 - 7. Conductor exposed to oil, insulation and jacket shall be oil resistant, complying with "Oil Resistant-1" and "Oil Resistant-2" UL 83.
- B. Conductor Insulation
 - 1. 600-volt AC and/or DC insulated conductors installed entirely inside conduits, or enclosed inside wireways, or enclosed inside raceways, insulation shall be rated as follows.
 - a. Indoor above Grade locations either concealed or exposed.
 - 1) Dual rated THHN and THWN
 - 2) Individually rated THHN-2
 - 3) Individually rated THWN-2
 - 4) XHHW-2
 - b. Outdoor above Grade either concealed or exposed.
 - 1) XHHW-2
 - 2) THWN-2
 - 3) THW-2
 - c. Outdoor below Grade or outdoor on Grade.
 - 1) XHHW-2
 - 2) THWN-2
 - 3) THW-2

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- d. All other enclosed raceway locations not described above.
 - 1) XHHW-2
 - 2) THWN-2
 - 3) THW-2
 - e. Health Care facilities all circuits insulation shall be XHHW-2, rated Hospital-Grade.
 - 2. 600 Volt AC and/or DC insulated conductors installed in open cable tray or open wireway or exposed insulation also shall be rated for exposed install locations.
- C. Insulation Color Coding and Identification
- 1. The following color code for branch circuits:
 - a. Neutral . . . White (Tape feeder neutrals with white tape near connections)
 - b. Normal Power:

<u>120/208 Volt</u>	<u>277/480 Volt</u>
Ground Green	Ground Green
Phase A Black	Phase A Brown
Phase B Red	Phase B Orange
Phase C Blue	Phase C Yellow
 - c. Isolated ground insulation shall be green with a longitudinal yellow stripe.
 - d. Emergency power same insulation color as normal power except as follows:
 - 120/208 Volt: Provide a continuous stripe on each conductor insulation, orange or yellow, except ground
 - 277/480 Volt: Provide an additional continuous stripe on each conductor insulation blue or black, except ground
 - 2. When individual neutral conductors are shown for each branch circuit, the color code for the neutral conductors shall be as follows:
 - a. 120/208 volt; Phase A - White with Black stripe; Phase B - White with Red stripe; Phase C - White with Blue stripe.
 - b. 277/480 volt; Phase A - White with Brown stripe; Phase B - White with Orange stripe; Phase C - White with Yellow stripe.
 - 3. Feeders identified as to phase or leg in each, switchboard, switchgear, panel-board, and junction location with printed identifying tape.
 - 4. Fire alarm conductors: Use 600-volt, type THHN-2/THWN-2 conductors and color-coded per Equipment Manufacturer's recommendations and approved and listed for use on fire alarm systems by the State Fire Marshal.
 - 5. Color coding for mechanical and plumbing control wiring shall be an agreed upon color code between the Mechanical/Plumbing Contractor and the Electrical Contractor, and color code shall be submitted to the District's Representative in writing for approval prior to installation.
- D. Panel Feeders, Copper or Aluminum:
- 1. Wire size shown on the Drawings is for copper conductors, unless specifically indicated otherwise.
 - 2. If aluminum wire is proposed, increase wire size to ampere capacity of copper wire and voltage drop not to exceed that of copper feeders indicated on Drawings. Increase conduit size and quantity as required by Code. Provide feeder calculation sheet, eight copies, if aluminum wire is proposed, showing feeder number, length, size, and voltage drop in percentage for original copper feeders and for equal aluminum feeders.

3. Aluminum Conductors (600 Volt or Less Only): Contractor has the option of using aluminum conductors in lieu of copper conductors for feeders only to panels, distribution boards/panels, switchboards, switchgear, transformers, motor control centers, and dimmer switchboard.
4. Aluminum Conductors shall be Aluminum Association AA-8000 Series Alloy, compact-stranded, with the same insulation as called for under copper conductors.
 - a. Aluminum conductor larger than 750 MCM shall not be used.
 - b. Aluminum conductors smaller than #2AWG shall not be used.
5. If the conductor termination is to be made on a bus bar or similar flat surface, a Burndy Type YA-A HYPLUG compression terminal intended for the specific conductor size, factory filled with oxide inhibitor compound shall be used. Terminal must be installed using a hydraulic compression tool equipment with a die head for the terminal used. Only Burndy Hypress tools shall be used for compression.
6. If the conductor termination is to be made into a circuit breaker or similar insert compartment it shall be terminated by use of a Burndy AYP HYPLUG compression connector intended for the specific conductor size, factory filled with oxide inhibitor compound. Connector must be installed using only Burndy Hydraulic compression tool specifically approved for each respective connector.
7. Connector aid shall be used for all terminations and connections. Connector aid shall be Burndy Pentrox A, NO-OX-1D Grade "A".
8. When an aluminum lug is terminated to a copper bus with a steel or copper stud or bolt, place aluminum lug on stud or bolt followed by a flat steel washer, a Belleville washer, and steel or copper nut, in that order.

2.05 CHEMICAL GROUND ROD

A. General

1. Self-contained ground rod(s) using chemically enhanced grounding shall be provided where specifically indicated on the Drawings. As manufactured by Lyncole XIT Grounding Systems, 22412 South Normandie Avenue, Torrance, CA. Telephone (800) 962-2610; or Superior Grounding Systems, Irwindale, CA. Telephone (800) 747-7925; or ERICO – Eritech Chemical Ground Electrode.
2. The ground rod shall operate from changes in atmospheric pressure pumping air through the ground rod, hygroscopically extracting moisture from the air to activate the ground electrolytic chemicals and improve the ground rod performance.
3. Ground rod system shall be UL-467 listed.
4. Ground rod system shall be 100% self-activating, sealed and maintenance free. The addition of chemical or water solutions shall not be required.

B. Ground Rod

1. Ground rod shall consist of a 2-inches nominal diameter hollow, copper tube. The tube shall be permanently capped on the top and bottom. Air breather holes shall be provided in the top of tube. Drainage holes shall be provided in the bottom and sides of the tube for electrolyte drainage into the surrounding soil.
2. The ground rod shall be chemically filled at the factory with environmentally non-hazardous water-soluble metallic salts to enhance electrical grounding performance.

3. Ground rod shall be a minimum of 10-feet long for straight (vertical) installation; or "L" shape minimum 20-feet long for horizontal installation.
 4. Ground wire clamping "U-Bolt" with pressure plate on the top end of the tube sized for 1#2 through 500 MCM AWG ground electrode conductor connection, and stranded 4/0AWG copper pigtail exothermically welded to the side of rod for ground electrode conductor connection.
- C. Ground Box
1. Precast concrete box with slots for conduit entrances. Approximately 10-inch diameter by 12-inches high. Cast iron grate flush cover with "Breather" slots XIT Box #XB-12.
- D. Backfill Material
1. Natural volcanic, non-corrosive Bentonite Clay backfill material.
 2. Shall absorb water at a minimum of thirteen times its dry volume or approximately 14 gallons for 50 pounds of clay.
 3. PH value 8-10 with maximum resistivity of 2.5 OHMS-M at 300% moisture content by weight.

2.06 FLEXIBLE CORDS AND PORTABLE CABLES

- A. General
1. Multi-conductor insulated flexible cable with jacket rated extra heavy duty, extra hard-use and high abuse duty; ozone, sunlight, grease, oil resistant-UL 83 and water resistant; rated for indoor/outdoor use.
 2. Quantity of conductors and conductor sizes as indicated on the Drawings but in no case less than five 16AWG.
 3. Characteristics:
 - a. Conductors - stranded copper, soft annealed conforming to ASTM-B-174 and ASTM-B-172. 600 volt individually insulated and color-coded. Separate green insulated ground conductor. Aluminum conductors shall not be permitted for cords and cables.
 - b. Insulation - rubber conforming to UL 62; temperature range plus 105° Centigrade to minus 50° Centigrade.
 - c. Flame resistance shall conform with MSHA-P123-103.
 - d. Jacket - black for equipment connections and yellow for outlet connections. Rated for temperature range plus 105° Centigrade to minus 50° Centigrade, water, sun-light and ozone resistant. Permanently mark jacket a minimum of 40-inches on center with rated voltage, Manufacturer's name, wire/insulation type, AWG conductor size and quantity (minimum 24-inches on center).

2.07 CABLE RACKS

- A. Cable racks, installed on the vertical walls of the structure, including hooks and porcelain insulator cable cradles, shall be sufficient to accommodate the cables and splices.

- B. Vertical racks shall be installed on all walls of the structure a minimum of 24-inches on center within 6-inches of floor and top of wall. A rack shall be installed within 18-inches of each corner of each wall. Additional racks spaced equally on each wall shall be installed; spacing between vertical wall racks shall not exceed 24-inches.
1. Wall racks shall be slotted to accept removable hooks and lock hooks into place.
 2. Non-metallic, 50% (minimum) glass reinforced nylon or non-metallic material of the same characteristics.
 3. The installed cable racks, cable support hooks with arms and wall anchor bolts shall support the following minimum loads for each hook/arm, with a 200% minimum safety factor. Based on multiple hook/arms located not less than 9-inches on center along the entire vertical length of the support rack:

<u>Hook/Arm Length</u>	<u>Min. Weight Each Hook/Arm Supported</u>	<u>Max. Allowable Hook/Arm Deflection</u>
a. 8-inches	450 pounds	0.25-inch
b. 14-inches	350 pounds	0.37-inch
c. 20-inches	250 pounds	0.37-inch

 (Based on load concentrated 1-inch from the end of each hook/arm).
 4. Racks shall be bolted to the precast and cast-in place structure walls, within 3-inches of each rack end and not less than 9-inches on center. Provide cast-in place or after-set drilled expansion concrete anchors.

PART 3 - EXECUTION

3.01 TRENCHING, FOOTINGS, SLEEVES

- A. Provide trenching, concrete encasement of conduits, backfilling and compaction for the underground electrical work, in accordance with applicable Sections of this Specification.
- B. Provide footings for all post and/or pole-mounted lighting fixtures: concrete shall conform to the applicable Sections of this Specification.
- C. Sleeves
 1. Provide sleeves for raceways, conduit and wire/cables passing through the following construction elements:
 - a. Concrete and masonry foundations, floors, walls, and slabs.
 - b. Gypsum, Lath, and plaster walls and ceilings.
 - c. Building structures (i.e., foundations, walls, floors, ceilings, beams, and roofs) with a fire rating exceeding 20-minutes.
 2. Sleeves shall extend 1.5-inch above and below floors, except under floor standing electrical equipment. Sleeves shall be flush with wall ceiling foundations and partitions exposed to public view and extend approximately 0.5-inch past penetration in fire rated construction. Sleeves shall be installed at exact penetration locations and angles to accommodate wire/cable, raceway and conduit routings.
 3. Joists, girders, beams, columns or reinforcing steel shall not be cut or weakened. Where construction necessitates the routing of conduit or raceways through structural members, framing or footings, written permission to make such installation shall first be obtained from the District's Representative. Such permission will not be granted, how-ever, if any other method of installation is possible.

4. The layout and design of raceways and conduits located in or routed through masonry or reinforced beams or the District's Representative shall review walls before any work is performed. All sleeving shall be accomplished according to the instructions of the District's Representative and shall be accepted before any concrete is poured.
5. Sleeves, raceways, and conduit shall be located to clear steel reinforcing bars in beams. Reinforcing bars in walls shall be offset to clear piping and sleeves.
6. Provide a continuous clearance between the inside of a sleeve and exterior of wire/cables, conduits and raceways passing through the sleeve not less than the following:
 - a. 0.5-inch clearance except as required otherwise.
 - b. 1.0-inch clearance through outside walls below grade.
 - c. 3.0-inch clearance through seismic joints.
7. Sleeves set in fire rated construction shall be caulked between sleeve and building structure, additionally sleeves shall be caulked between the sleeve and the wire/cables, conduits/raceways passing through the sleeve. The caulking shall be a fireproof sealant, equal to the fire rating and temperature being penetrated. Clearance between components inside of sleeve and exterior of components passing through sleeve and between components inside the sleeve shall comply with Fireproof Sealant Manufacturer's recommendations.
8. Sleeve material:
 - a. In floor construction: Schedule 40 black steel pipe, with upper surface to be sealed watertight.
 - b. In concrete or masonry walls roofs or ceilings: Schedule 40 black steel pipe. When installed in roofs or outside walls, seal outer surface watertight.
 - c. In fire rated construction; 24-gauge galvanized iron or steel.
 - d. Sleeves through waterproof membranes: Cast iron or Schedule 40 steel with flashing clamp device and corrosion resistant clamping bolts. Caulk space between pipe and sleeve and surfaces between sleeve and conduits sealed watertight.

3.02 GROUNDING

- A. Grounding shall be executed in accordance with all applicable Codes and Regulations, both of the State and Local Authorities Having Jurisdiction.
- B. Where nonmetallic conduit is used in the distribution system, the Contractor shall install the proper sized copper ground wire in the conduit with the feeder for use as an equipment ground. The electrical metallic raceway system shall be grounded to this ground wire.
- C. The maximum ground/bond resistance to the grounding electrode shall not exceed 1 ohm from any location in the electrical system. The maximum ground resistance of the grounding electrode to earth shall not exceed 5 ohms.

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D. Ground/Bond Conductors

1. Provide an additional, dedicated, green insulation equipment ground/bond wire inside each conduit type and raceway as follows. Size the ground/bond conductors to comply with CEC/NEC Requirements. The metal conduit or raceway shall not be permitted to serve (function) as the only (exclusive) electrical ground return path:
 - a. All types of nonmetallic conduit and all types of non-metallic raceways including but not limited to: RNMC - Rigid Nonmetallic Conduit.
 - b. FMC - Flexible Metal Conduit.
 - c. LTFMC - Liquid Tight Flexible Metal Conduit.
 - d. Metal and non-metal raceways.
 - e. RMC - Rigid Metal Conduit.
 - f. EMT - Electrical Metal Tubing.
2. The equipment ground/bond wire shall be continuous from the electrical circuit source point of origin to the electrical circuit end termination utilization point as follows:
 - a. Every conduit and raceway path containing any length of the above identified conduits or raceway.
 - b. Every conduit path and raceway path connected to any length of the above-identified conduits and raceways.
3. The equipment ground/bond wire shall be sized as follows, but in no case smaller than indicated on the Drawings. Install equipment ground/bond wire in each conduit/raceway, with the respective phase conductors:

<u>Feeder, Sub-feeders and Branch Circuit Protection</u>	<u>Min. Equipment Ground Copper Wire Size</u>
15 amp	#12
20 amp	#12
30 to 60 amp	#10
70 to 100 amp	#8
101 to 200 amp	#6
201 to 400 amp	#2
401 to 600 amp	#1
801 to 1000-amp	2/0
1001 to 1200-amp	3/0
1201 to 1600-amp	4/0
1601 to 2000 amp	250 MCM
2001 to 2500 amp	350 MCM
2501 to 4000 amp	500 MCM
4. Isolated grounds - Raceways containing branch circuit or feeder phase conductors connected to panelboards equipment, or receptacles with isolated grounds or isolated ground bus shall contain a dedicated insulated ground conductor connected to the isolated ground system only. The isolated ground conductor shall be continuous the length of the raceways and connected only to the isolated ground terminals in addition to and independent of the equipment bonding/ground conductor. The isolated ground conductor shall be sized as indicated above, for equipment ground/bond wire.
5. Splices in ground/bond wires shall be permitted only at the following locations:
 - a. Ground buses with listed and approved ground lugs.
 - b. Where exothermic welded ground/bond wire splices are provided.
6. Provide ground/bond wire jumpers for conduit fittings with ground lugs, expansion and deflection conduit fittings at conduit fittings connecting between metallic and non-metallic raceways and to bond metal enclosures to conduit fittings with ground lugs.

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- E. Where conductors are run in parallel in multiple raceways, the grounding conductor shall be run in parallel. Each parallel equipment-grounding conductor shall be sized on the basis of the ampere rating of the overcurrent device protecting the circuit conductors in the raceway. When conductors are adjusted in size to compensate for voltage drop, grounding conductors, where required, shall be adjusted proportionately in size.
- F. Ground conductors for branch circuit wiring shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws, 6-32 or larger.
- G. Each panelboard, switchboard, pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.
- H. UFER Ground
 - 1. In addition to all cold water and structural steel grounds provided to meet this Specification, there shall be a main ground system of the UFER ground style.
 - 2. The UFER ground electrodes shall be a minimum of two 20-foot lengths of #4/0 AWG bare stranded copper cable embedded horizontally in the cast in place concrete footing, extending in opposite directions in the footings. All portions of the ground electrodes shall be placed inside the concrete, between 2-inches and 4-inches from the earth surrounding the concrete.
 - 3. The lengths of cable shall extend in opposite directions in the footings, with the center end of each cable terminated onto the main electrical service ground bus for the main electrical service equipment.
 - 4. All wire cable connection terminations onto the ground bus shall be exothermic weld type.
 - 5. The "UFER" grounding electrode, embedded in concrete, shall be exothermically welded to each steel reinforcing bar (rebar) and each steel anchor bolt located within 18-inches of the grounding electrode inside the concrete. Note: Reinforcing steel (rebar), in concrete foundations, attached with metal "tie-wraps" and in direct physical contact to other adjacent rebar that is in turn exothermic welded to the ufer grounding electrode, may be classified as attached to the ufer grounding electrode, and does not require additional exothermic weld connections to the ufer grounding electrode.
- I. Provide a separate ground/bond insulated grounding electrode conductor, copper wire from the main electrical service ground bus to each of the locations. The ground/bond conductor shall be sized to comply with applicable Codes and as indicated on the Drawings, but in no case smaller than the following:
 - 1. Main service entrance equipment ground bus:
 - a. Services smaller than 1200 amp 1.5-inch conduit with 1#4/0.
 - b. Services 1200 amp and larger 2.5-inches conduit with 1#500MCM.
 - c. Where a separate ground bus is not required, connect ground to electrical equipment metal housing
 - 2. Each telephone backboard and signal system backboard location, 1.25-inch conduit with 1#1.
 - 3. Metal cold-water pipe located inside the building, 1.5-inch conduit with 1#4/0.
 - 4. Outdoor underground metal cold water pipe makes connection 5-feet from the building, 1.5-inch conduit with 1#4/0.

5. Each service entrance ground bus and each separately derived ground rod system:
 - a. Services smaller than 1200 amp 1.5-inch conduit with 1#4/0.
 - b. Services 1200 amp and larger 2.5-inches conduit with 1#500MCM.
6. Separate 1.25-inch conduit with 1#2 (AWG) bonding conductor to each interior metal pipe system located in the same building, including but not limited to, the following:
 - a. Fire sprinkler system each stand-pipe location (water based and non-water based).
 - b. HVAC chilled water supply and return, at each pump location.
 - c. Roof drains.
 - d. Waste liquid disposal systems.
 - e. Metal gas pipe service entrance and service meters.
 - f. Hydraulic elevator hydraulic pipes.

3.03 CONDUIT

- A. General
 1. The sizes of the conduits for the various circuits shall be as indicated on the Drawings, but not less than the conduit size required by Code for the size and quantity of conductors to be installed in the conduit.
 2. Conduits shall be installed concealed from view. Install conduits concealed in walls, concealed below floors, and concealed above ceilings, except as specifically noted otherwise.
 - a. Conduits shall not be installed in concrete floors.
 3. The following systems shall be considered as circuits 100 volts and less, all other circuits shall be considered to be over 100-volts (power circuits) unless specifically noted other-wise: Fire alarm, energy management control, telephone, public address, data, computer, television, intercom, intrusion alarm and nurse call.
 4. Conduits shall be provided complete with conduit bends, conduit fittings, outlet boxes, pullboxes, junction boxes, conduit anchors/supports, grounding/bonding for a complete and operating conductor/wire raceway system.
 5. Metal and nonmetal conduits shall be provided mechanically continuous between termination connection points. Metal conduit shall be provided electrically continuous between termination connection points.
 6. Individual conduit paths and home runs shown on the Drawings shall be maintained as separate individual conduits for each homerun and path.
 7. Conduits, conduit fittings and installation work occurring in classified hazardous materials locations shall comply with applicable Code Class 1 Division 1 Requirements, unless specifically noted otherwise.
 8. Transitions between conduits constructed of different materials and occurring in above grade locations shall be allowed only at outlet boxes, junction boxes, pullboxes and equipment enclosures unless specifically indicated otherwise. Provide outlet boxes and junction boxes.
 9. Metal conduit terminating to nonmetal enclosures; terminating into metal enclosures with "concentric ring" knockouts; terminating into metal enclosures with knockout reducing washers, including but not limited to equipment housings, outlet boxes, junction boxes, pull boxes, cable trenches, manholes, shall be provided with a ground/ bonding lug integrated with the conduit termination conductor fitting construction, by the Fitting Manufacturer. The lug shall provide for connection of a grounding/bonding conductor (insulated or

uninsulated). The grounding lug shall be located on the fitting, inside the termination enclosure.

10. The type of conduit, type of conduit fittings, and type of conduit supports and method of conduit installation shall be suitable for the conditions of use and conditions of location of installation based on the Manufacturer's recommendations; based on the applicable Codes and based on the Requirements of the Contract Documents.

B. RMC Installation Locations

RGS, IMC conduits and RGS, IMC fittings shall be installed in the following locations:

1. Embedded in floors, walls, ceilings, roofs, foundations, and footings constructed with concrete.
2. Embedded in walls and foundations constructed with brick and masonry.
3. Interior of buildings, within 9-feet of finish floor lines for exposed conduit locations.
4. Exterior of building for exposed conduit locations.
5. Damp or wet locations, exposed or concealed locations.
6. Exposed on roofs.
7. In hazardous materials areas and locations; below hazardous materials areas and locations; above hazardous materials areas and locations.
8. Exposed on utility service poles, for pole risers less than 9-feet above finish grade.
9. RMC conduit and RMC fittings may be installed in any location where EMT and FMC conduit is permitted to be installed.

C. PVC Coated RMC Installation Locations

PVC Coated RMC conduit and PVC Coated RMC fittings shall be installed in the following locations:

1. Underground conduit locations for elbows and bends with a radius of less than 36-times the conduit diameter.
2. Underground vertical risers extending above grade.
3. Entire length of underground conduits for the following circuits:
 - a. Audio microphones
 - b. Lighting dimming controls
4. Installed in contact with earth or corrosive materials.
5. Exposed in "cold" rooms and "refrigerated" rooms, rooms with a maintained temperature below 65 degrees Fahrenheit.

D. EMT Installation Locations

EMT conduit and EMT fittings may be installed in the following locations, for circuit conductors operating below 600 volts to ground; locations containing only "non-hazardous materials"; only dry locations:

1. Concealed in hollow non masonry/non-concrete, metal stud frame and wood stud frame walls and floors.
2. Concealed above ceilings.
3. Exposed inside interior enclosed crawl spaces.
4. Exposed interior locations placed 9-feet or higher above finished floors (except as described in paragraph below at lower heights).
5. Exposed on walls and ceilings (any height) in the following dedicated function areas, interior enclosed room locations:
 - a. Indoor enclosed electrical equipment rooms and closets.
 - b. Indoor enclosed data and telecommunication terminal rooms and closets.

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- c. Indoor enclosed HVAC equipment rooms and closets.
- 6. Any location where FMC is described to be installed, except as the final connection to rotating or vibrating equipment.
- E. FMC Installation Locations
FMC conduit and FMC fittings may be installed in the following locations for circuit conductors operating below 600 volts to ground; locations containing only “non-hazardous materials”; only dry, interior locations:
 - 1. Concealed in hollow non-masonry metal stud frame and wood stud frame fully enclosed walls.
 - 2. Concealed above fully enclosed ceiling spaces.
 - 3. FMC conduit shall be installed in continuous lengths between termination points. FMC shall not be “spliced” or coupled directly to FMC or any other conduit type under any circumstance.
 - 4. The maximum continuous length of FMC that shall be installed between termination end points is 15-feet. Circuits requiring continuous conduit lengths exceeding 15 feet between termination end points shall be installed using either RMC or EMT conduits. FMC lengths shorter than 16-inches are prohibited.
 - 5. The minimum size FMC conduit shall be as shown on the Drawings but not be less than the following:
 - a. FMC lengths of 6-feet or less, minimum FMC conduit size shall be 0.50-inch.
 - b. FMC lengths exceeding 6-feet, minimum FMC conduit size shall be 1.0-inch.
- F. LTFMC Installation Locations
LTFMC conduit and LTFMC fittings shall be installed in the following locations for circuit conductors operating below 600 volts to ground; locations containing only “non-hazardous materials”:
 - 1. Final electrical connection to vibrating or rotating equipment; control and monitoring devices mounted on vibrating and rotating equipment including the following. Minimum conduit length shall not be less than 24-inches:
 - a. Motor, engines, boilers, solenoids, and valves.
 - b. Fixed mounted “shop” (manufacturing) production equipment.
 - c. Fixed mounted food preparation equipment and “kitchen” equipment.
 - 2. All locations where exposed flexible conduit connections are required, both indoor and outdoor.
 - 3. Final connection to indoors electrical transformers. Minimum conduit length shall not be less than 24-inches; maximum conduit length shall not exceed 72-inches.
 - 4. Do not install LTFMC located in environmental air plenums.
- G. RNMC Installation Locations
RNMC conduit and RNMC fittings shall be installed in the following locations containing only “non-hazardous material”:
 - 1. Underground, concealed below earth grade, unless specifically noted or specified otherwise.
 - 2. Exposed on utility service poles, for pole risers at 9-feet or higher above finish grade, Schedule 80 PVC only.
 - 3. RNMC type “EB” conduit(s) shall be concrete encased along the entire length of the conduits for all installation locations.

4. Non-metal type raceways and RNMC type conduit shall not be installed inside buildings.
- H. Combi-Duct Installation Locations
- Combi-duct conduits shall be installed where shown on the Drawings. Combi-duct shall be installed underground (below grade) as follows:
1. Do not install exposed or inside buildings above grade.
 2. Provide a 0.25-inch pull rope in each inner duct.
 3. Radius and elbows shall be rigid non-metallic, PVC, Manufacturer factory fabricated, in lieu of PVC coated RMC conduit.
 4. Inner ducts shall be supported by internal spacers inside the enclosing outer duct.
 5. Provide end bell and three-hole "snug-plugs" at each entrance end of Combi-duct into pullboxes, manholes, equipment cabinets stub-ups and Combi-duct terminations. Compression type "snug-plugs" shall provide watertight and airtight seal between inner and outer ducts and around future cables installed in inner duct.
- I. Conduit Installation
1. Conduit Supports
 - a. Securely and rigidly support all raceways/conduits from the building structure. Race ways/Conduits shall be supported independent of all piping, air ducts, equipment ceiling hanger wires, and suspended ceiling grid systems. Secure conduit to structural element by means of UL listed and approved hangers, fasteners, "C" channels and pipe clamps.
 - b. Provide conduit supports spaced along the length of the conduit as follows:
 - 1) RMC and EMT conduit, maximum not to exceed 96-inches on center; within 24-inches of each conduit bend and conduit termination location.
 - 2) FMC and LTFMC conduit, maximum not to exceed 24-inches on center; within 6-inches of each conduit bend and conduit termination location.
 - c. Suspended conduit methods:
 - 1) Individual, suspended raceways/conduits separated by more than 12-inches from any other conduit and suspended from ceilings and roofs shall be supported as follows:
 - a) Conduits smaller than 1.5-inches by means of hanger rods or hanger wires.
 - b) Conduits 1.5-inches and larger by means of hanger rods.
 - c) The conduit shall attach to the hangers with pipe clamps.
 - 2) Suspended raceways/conduits positioned within 24 inches of any other conduit shall be grouped and supported by hanger rods using trapeze type conduit support channels ("C" channels). Conduits shall individually attach to common channels side-by-side, with pipe clamps.
 - d. Non-suspended conduit methods:
 - 1) Individual raceway/conduits placed against wall/ceiling/floors, placed inside hollow wall/ceiling construction or structure framing (i.e., "dry- wall" or plaster hollow wall construction), shall be secured by means of individual pipe clamps and fasteners attached to the framing studs or other structural members and the conduit/raceway.

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- 2) Provide common "C" channel supports for all multiple raceway/ conduits placed against vertical or horizontal surfaces and positioned within 24-inches of other raceways/conduits. Attach channels to the framing studs or other structural members. Attach the conduits/raceway individually to common channels, side-by-side, with pipe clamps.
 - 3) The use of toggle bolts is prohibited.
 - e. Conduit rising from floor for motor connection shall be independently supported if extending over 18-inches above floor. Support shall not be to a motor or ductwork, which may transmit vibrations.
 - f. Provide conduit anchoring, conduit support and conduit bracing systems conforming to Earthquake Seismic Requirements. The conduit support / anchoring system capacity shall include the weight of the conduits, conduit fittings, conduit supports, and conductors/wires/cables installed in the conduits plus a 300% safety factor. Submit Shop Drawing details showing each typical conduit anchor, conduit support and conduit brace location. Submit Structural Calculations performed by and signed by a Professional Structural Engineer (P.E.) with a P.E. License, Registered in the State of California, U.S.A.
- 2. Conduit separation:
 - a. Conduit installed underground or below building slab without full concrete encasement: Shall be separated from adjacent conduits of identical systems (i.e. signal to signal, data to data, power to power, control to control etc.) by a minimum of 3-inches. Conduits of non-identical systems (i.e. signal to power; data to power; power to control; signal to control, etc.) shall be separated by a minimum of 12-inches.
 - b. Conduit installed underground with full concrete encasement; shall be separated from adjacent conduits of similar systems (100 volt and less) by a minimum of 2-inches; conduits for non-power systems (100 volts and less to ground) shall be separated by a minimum of 6-inches from power circuits (over 100 volts to ground); conduits for power circuits shall be separated from adjacent conduits of similar power systems (over 100 volts to ground) by a minimum of 3-inches.
 - c. Separation of conduits entering termination points or crossing other conduits may be reduced as required within 60-inches of the termination or crossing points.
 - d. Conduits containing Utility Company service circuits (i.e. electrical power, telephone, or cable television) shall be separated a minimum of 12-inches from all other utilities and conduits, with or without concrete encasement; metallic or non-metallic conduit, above grade or underground conduit locations.
 - e. Conduits shall be separated from hot water piping, exhaust flues/ chimneys, steam piping, boilers, furnaces, ovens by a minimum of 12-inches.
- 3. Conduit stubs:
 - a. Branch circuit and telephone conduits turned up from floor at the following locations shall terminate each conduit in a flush conduit coupling at the floor and then extend into partition or to equipment. Refer to District's Representative's Drawings for location of walls and partitions.
 - 1) Interior demountable partitions.
 - 2) Below, into or adjacent to equipment not installed directly adjoining to a wall.
 - 3) Up from below the floor into hollow stud frame walls.

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- b. From each panel, and signal cabinet which is wall mounted, stub up from top of the panel/cabinet a minimum of three 1-inch conduits to the nearest accessible ceiling spaces or other accessible location. Where the floor below the panel is accessible or is a ceiling space, stub an additional three 1-inch conduits from the bottom of the panel into the accessible space below the panel. Cap conduits for future use.
- c. Conduits stubbed underground outside of building line for future use shall be terminated a minimum of 5-feet clear (whichever distance is greater) of building or adjacent concrete walks and AC paving. The stubout conduit shall be capped. Provide concrete monuments, 6-inches by 6-inches by 15-inches deep, buried flush with grade over the capped ends. The face of monument shall be furnished with 3-inch square brass plates securely mounted and engraved with the number and size of conduits and type of service (i.e., "POWER", "TEL.", etc.).
- d. Conduits stubbed into ceiling or floor spaces from outlets for telephone, video, computer/data, or television shall be provided with an insulated throat bushing, on the end of each conduit stubout.
- e. Conduit stub-outs from outlet boxes and equipment located in hollow stud walls, into ceiling and floor spaces, shall be EMT or RMC conduit. The stub-outs shall terminate into the ceiling and floor spaces with a conduit termination connector fitting.
- f. Empty conduit stubs into building spaces and equipment shall be individually identified with an "ID-tag" located at each end of the conduit. The ID-tag shall state the origination point and termination point of the respective conduit (i.e., "from PNL-A/to Room #121"; "from outlet #24/to outlet #17 in Room #120"; etc.).
- g. Provide a conduit termination fitting with insulated throat bushing and mechanical ground lugs at each conduit "stub-up" location.
- 4. Conduit concrete encasement:
 - a. Conduits which are run underground exterior to building slab shall be continuously concrete encased except, 15-amp and 20-amp power branch circuit conduits under-ground do not require concrete encasement.
 - b. PVC rigid-non-metallic-type EB conduit, of any size and any location shall be continuously concrete encased the full length of the conduit installation, including under building slab.
 - c. Concrete for encasement of underground conduits shall be 2000-PSI 28-days cure strength with a mix of cement, sand, water and maximum of $\frac{3}{4}$ -inch gravel. Concrete encasement of conduits shall be continuous without voids. The encase-ment shall extend 3-inches past the edges of all conduits on all sides of the circuit. Provide 10-pounds of red oxide cement coloring uniformly mixed with each cubic yard of concrete for conduit encasement.
 - d. Conduits located below or adjacent to structural foundations shall be separated from the foundation by a minimum of 12-inches. Conduits located below structural foundations shall be fully and continuously concrete backfilled and encased between the bottom of the foundation to the bottom of the conduits. The concrete shall be 4000 PSI 28-day cure strength instead of 2000-PSI concrete.
 - e. Conduits of any size and type (including 15 amp and 20-amp power branch circuits) located under roads, paved areas and "transit-system" right of way shall be concrete encased.

5. Underground conduits:
 - a. Three or more underground conduits larger than 1-inch in size and occupying the same trench shall be separated and supported on factory fabricated, non-metallic, duct/conduit support spacers. The spacers shall be modular, keyed interlocking type, "built-up" to accommodate quantity, size orientation and spacing of installed conduits.
The spacers shall maintain a constant distance between adjacent conduit supports and hold conduits in place during trench backfill operations. Minimum support spacer installation interval along with length of the conduits shall be as follows:
 - 1) Concrete encased conduits, not less than 8-feet on center.
 - 2) Non-concrete encased conduits, not less than 5-feet on center.
 - b. Provide trenching, excavation, shoring, and Backfilling required for the proper installation of underground conduits. Tops of backfill shall match finish grade.
 - c. Bottoms of trenches shall be cut parallel to "finish grade" elevation. Make trenches 12-inches wider than the greatest diameter of the conduit.
 - d. Backfilling Trenches for Conduits without Concrete Encasement Requirements
 - 1) Conduits which are not required by the Contract Documents to be concrete encased and are located exterior to building slab, shall be set on a 3-inch bed of damp clean sand. Conduit trenches shall be backfilled to within 12-inches of finished grade with damp sand after installation of conduit is completed. Remainder of backfill shall be native soil.
 - 2) Conduits located under a building which are not required by the Contract Documents to be concrete encased, shall be completely backfilled and compacted with clean damp sand to the same level as the building foundation pad.
 - 3) Provide a continuous yellow 12-inches wide flat plastic tracer tape, located 12-inches above the conduits in the trench. The tracer tape shall be imprinted with "Warning-Electric Circuits" a minimum of 24-inches on center.
 - e. Backfilling trenches for conduits under paved areas:
 - 1) In addition to the Requirements of conduit concrete encasement, conduits under walkways, roads, parking lots, driveways, and buildings shall be cast in place concrete "slurry mix" backfill. The slurry mix shall cover each side and top of conduits and conduit concrete encasement. The slurry mix shall be continuous to the underside of the finish subgrade surface.
 - f. Backfilling trenches for conduits with Concrete Encasement Requirements by the Contract Documents:
 - 1) Trenches with all conduits concrete encased shall be backfilled with clean damp sand when located under building pads.
 - 2) Trenches with all conduits concrete encased and not located under a building pad and not located under paved areas shall be back-filled with clean damp sand or native soil.
 - g. Backfill material:
 - 1) Sand and native soil backfill of trenches shall be machine vibrated in 6-inch lifts to provide not less than 90% compaction of backfill.
 - 2) Soil backfill shall have no stones, organic matter or aggregate greater than 3-inches.

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- 3) Concrete and slurry mix (2000-PSI) shall be machine vibrated during installation to remove "air-voids".
 - 4) The slurry mix shall consist of concrete, clean rock, clean sand and clean water mixture. Maximum shrinking of slurry mix shall not exceed 5% wet to dry.
- h. Do not backfill until District's Representative has approved Installation and As-Built Drawings are up to date. Promptly install conduits after excavation has been done, so as to keep the excavations open as short a time as possible. Excess soil from trenching shall be removed from the site.
- i. Install underground conduit, except under buildings, not less than 24-inches below finished grade in non-traffic areas and 30-inches below finished grade in traffic areas, including roads and parking areas. Not less than 48-inches below finished grade under public/private transit system right of way and railroad right of way. Dimensions shall be measured to the top of the conduit.
- j. Conduit crossing existing underground utilities shall cross below the bottom depth of the existing utilities. If the top portion of the existing utility depth below finish grade exceeds 72-inches and the specified separation and depths are maintained when crossing over the top of the existing under-ground utility, the conduit may cross above the existing underground utility.
- k. Provide long radius horizontal bends (minimum radius of 36-times the conduit dia-meter) in underground conduits where the conduit is in excess of 100-feet long.
- l. Conduits installed below grade and on grade below buildings, shall not be smaller than 0.75-inches. Conduits for circuits exceeding 600-volts shall not be smaller than 5.0-inches.
- m. Underground conduits entering a building shall be sloped. The conduit direction of slope shall be away from the building and shall prevent water in the conduit from "gravity draining" towards the building. The conduit slope "high point" shall originate from the building, out to the first exterior pullbox, manhole etc. exterior conduit termination "low point". The minimum slope angle shall be a constant 8-inches (or greater) of fall for each 100-feet of conduit length.
- n. Dewatering:
 - 1) Provide pumping to remove, maintain and dispose of all water entering the excavation during the time the excavation is being prepared, for the conduit laying, during the laying of the conduit, and until the backfill at the conduit zone has been completed. These provisions shall apply on a continuous basis. Water shall be disposed of in a manner to prevent damage to adjacent property. Trench water shall not be drained through the construction. Ground water shall not be allowed to rise around the pipe until joining compound has firmly set.
 - 2) The District's Representative shall be notified 48 hours prior to commencement of dewatering.
6. Raceway/Conduits, which are installed at this time and left empty for future use, shall have 0.25-inch diameter polyvinyl rope left in place for future use. The pull rope shall be 500-pound minimum tensile strength. Provide a minimum of 5-feet of slack at each end of pull ropes.
7. Unless otherwise restricted by Structural Drawings and Specifications, the maximum size conduit permitted in concrete slab on-grade, walls, ceilings, and

roofs constructed of masonry or concrete shall not be greater than 20% of the concrete/masonry thickness. Conduits installed in these locations shall not cross.

- a. Conduits shall not be installed in cast-in-place concrete floors.
8. Provide openings in building structures for conduit penetrations:
 - a. New construction shall be provided with conduit sleeves, to provide conduit penetrations.
 - b. Existing construction shall be drilled (core drill masonry and concrete) and provide conduit sleeves installed after drilling, to provide conduit penetrations.
 - c. Where the structure penetrations for underground conduits penetrating through foundations will not comply with the (restriction/penetration) shown in the Contract Documents, install the conduits below and clear of the foundation lowest point.
9. Conduit bends risers and offsets:
 - a. The minimum bend radius of "factory or field" fabricated conduit bends shall not be less than the following. The bend radius shall be measured at the surface, inside radius of the conduit wall:
 - 1) FMC and LTFMC conduit - conduit minimum bend radius 12-times the conduit diameter.
 - 2) RMC and EMT conduit minimum bend radius - conduit for power circuits over 100 volts and less than 600 volts, 8-times conduit diameter. Conduit for power circuits over 600 volt, 12-times conduit diameter. Conduit for low voltage, signal and fiber optic circuits, 10-times conduit diameter.
 - 3) RNMC conduit - conduit minimum bend radius 36-times the conduit diameter. Under building reduce minimum bend radius to 10-times the conduit diameter. Conduit bends and offsets in RNMC with less than 36-times conduit diameter bend/offset radius shall be RNMC PVC Schedule 80 or PVC coated RGS.
 - 4) Conduits for Utility Company conductors. Conduit minimum bend radius shall comply with the respective Utility Company Requirements.
 - b. Bends and offsets in conduits shall be kept to an absolute minimum. The total summation of all bends and offsets permitted in a conduit segment, occurring between two conduit termination/connection end points, shall not exceed the following, including conduit fittings:
 - 1) RMC and EMT conduit - 360 angular degrees
 - 2) FMC and LTFMC conduit - 180 angular degrees
 - 3) RNMC conduit - 270 angular degrees
 - c. Each field fabricated conduit offset, bend and elbow which are not the standard product of the Raceway/Conduit Manufacturer shall be mandrel tested. The test shall be conducted after the conduit installation is complete and prior to pulling-in any wire, in the same manner as for underground conduits.
 - d. Factory manufactured angle connector conduit fittings shall be installed in exposed conduit locations only. Installation in locations normally concealed from view shall not be permitted. Not more than one factory manufactured angle connector shall be permitted in any length of conduit between conduit termination end points.
 - e. RNMC conduit risers from below grade shall be PVC coated RGS. Conduit risers, bends or offsets entering a building shall be PVC coated RGS.

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- f. If three or more conduit-bends of the same conduit size and same conduit material type, installed, as part of the Contract Work, fail to comply with the required minimum conduit bend radius or conduit angular degree limits. The following corrective actions shall occur:
- 1) The Contractor shall remove all the non-complying conduit bends and the respective wire in the conduit from the Project Site. Provide new conduit and wire, complying with the Contract Documents.
 - 2) Where the conduit bends similar to the non-complying conduit bends are installed concealed in walls, floors, above ceilings or below grade, the Contractor shall expose the conduit bends to allow visual observation.
 - 3) The Contractor shall remove the non-complying conduit bends and dispose of the Project Site. The Contractor shall provide new conduit bends and conductors complying with the Contract Documents.
 - 4) All the costs to correct the deficient material and work along with costs to repair the direct, indirect, incidental damages and Contract delays shall be the sole responsibility of the Contractor and shall be included in the bid price.
10. Expansion joint, deflection joint and seismic joint fittings.
- a. Provide a conduit expansion fitting for each conduit length and conduit type as follows (Note - The installation of specified combination expansion/deflection fittings at seismic joints shall satisfy this Spacing Requirement also):

	<u>Conduit Type</u>	<u>Conduit</u>	<u>Fitting Length Spacing</u>
1)	RMC and EMT	Exposed exterior locations	200-feet
2)	RMC and EMT	Interior weather protected locations	400 feet
 - b. Provide a conduit combination expansion/deflection fitting for each conduit, crossing the following elements:
 - 1) At each building or non-building structure seismic joint.
 - 2) At each building on non-building structure expansion joint.
 - 3) At each conduit penetration of a "sound-rated" wall, floor, or ceiling.
11. Provide two locknuts and an insulated throat bushing at each metal conduit terminating at enclosures, including but not limited to outlet boxes, junction boxes, terminal cabinets, switchgear, transformers, switchboards, distribution panels and panelboards.
12. Provide metallic or plastic closure caps on all conduit ends during construction, until installation of conductors in the respective conduit.
13. Conduit run exposed, shall be run at right angles or parallel to the walls or structures. All changes in directions, either horizontally or vertically, shall be made with conduit outlet bodies as manufactured by Crouse Hinds, OZ or equal. Conduits run on exposed beams or trelliswork shall be painted to match surrounding surfaces.
14. Conduit exposed on roof:
- a. Conduits installed exposed on roofs shall be installed on conduit sleepers. Place the conduit sleepers a maximum 5-foot on center along the entire length of the conduit; under conduit expansion/deflection fittings; under each junction box and within 24-inches of each conduit bend.
 - b. Provide a conduit support "C" channel continuous along the top length of the sleeper and rigidly bolted to the sleeper. Conduits shall be loosely

- fastened to each sleeper "C" channel with pipe clamps to allow for relative movement between the sleeper and conduit.
- c. Conduits shall not block or interfere with roof hatches, doors, ventilation openings, dampers, equipment access panels/doors, roof water drainage.
 - e. Conduit sleepers shall be fabricated from "clear" solid redwood 4-inches by 4-inches (nominal) size. Sleeper length shall extend a minimum of 9-inches past the conduits attached to the sleeper, but in no case shall the length of the sleeper be less than 24-inches.
 - f. Provide a pad under each sleeper; sleepers shall not be installed in direct contact with the roofing. Sleeper pads shall extend a minimum of 6 inches past each side of the sleeper. The sleeper pad shall be semi-rigid mineral surfaced composition board, not less than 0.375-inch thickness, bituminous impregnated, manufactured for application on the specific roofing material. Remove roofing "ballast" (gravel) under pad, prior to installation of sleeper pad. Do not puncture roof membrane.
 - g. Position the "length" of the conduit sleepers' perpendicular to the roof slope, to prevent obstruction of roof drainage water flow. Where the conduit routing prevents placing the conduit sleeper parallel to the roof slope, provide two separate sleeper pads for the conduit sleeper, with a continuous 3-inches wide water drain-age gap between the sleepers. Align the water drainage gap to allow unimpeded water travel along the roof slope drainage flow line between the pads.
 - h. Sleepers and sleeper pads shall be set in nonhardening mastic, a minimum of 0.25-inch thickness. Mastic shall be inorganic, nonhardening, and complying with ASTM-D1227. Mastic shall be applied with continuous uniform coverage, minimum 0.25-inch thickness, on all the surfaces of each conduit sleeper and on the sleeper pad contact surface with the roof.
15. Rigid steel conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock absorbing bases.
16. RMC conduit threads:
- a. Machine cut threads on RMC conduit required for field fabrication shall comply with NPS and ANSI-B1.20.1.
 - b. The length of bare metal exposed during thread fabrication shall be completely covered by conduit couplings and fittings. Additionally, the thread length shall insure that conduit joints will reach "torque" tightness and become secure before conduit ends "butt" together and before conduit ends "butt" into the "shoulders" of other conduit fittings.
 - c. Running threads or right/left-handed threads shall not be used to connect RMC.
17. RNMC conduit:
- a. Joints and fittings shall be solvent welded to RNMC conduit. Joints and fittings shall be watertight and airtight after fabrication.
18. Tighten each conduit fittings and fitting appurtenance, to the "torque" (allowable tolerance $\pm 5\%$) value recommended by the fitting Manufacturer and applicable Code. If three or more conduit fittings are found to not be in compliance with the Manufacturer's "torque" (tightness) recommendations, the following corrective actions shall occur:
- a. The Contractor shall tighten "re-torque" the defective fittings and all similar conduit fittings installed as part of the Contract Documents in the presence of the District's Representative.
 - b. If the respective conduit fittings similar to the deficient "torque tightness" fittings are installed concealed in walls, floors, above ceilings or below

- grade, the Contractor shall expose the fitting, to allow retightening each similar conduit fitting to the Manufacturers recommended "torque" values.
- c. All the cost to repair the direct, indirect, incidental damages and Contract delays resulting from complying with these Requirements shall be the sole responsibility of the Contractor and shall be included in the bid price.
19. Horizontal directional boring for underground conduit:
- a. Provide a directional guided horizontal "bore-hole" underground conduit installation where one or more of the following conduits occur:
 - 1) Continuous trenching excavation and backfill for conduit installation is not permitted by the Contract.
 - 2) Where continuous trenching excavation due to the existing surface and below grade conditions and restrictions, is not possible or practical to excavate a trench.
 - b. Provide "path-tracing" of the underground bore head, from the surface, along the entire horizontal bore length. Path tracing shall use electronic transmitters and receivers, continuously communicating the underground bore head locations and depth to the bore equipment operator. The directional boring system shall employ active tracking and directional position/steering control of the bore equipment drill head location. The active tracking system shall provide a portable receiver/transmitter unit for tracking the position of the moving drill head; a sensor "Sonde" unit on the drill head for tracking signals to the receiver/transmitter; and a drill head tracking data view display located at the boring equipment operator position to view the drill head position information sent from the portable receiver/transmitter. As manufactured by SPX-Radiodetection Company or similar products.
 - c. Provide vertical pilot excavations not more than 50-feet on center along the path of the bore-hole to intercept the horizontal bore-hole routing, provide excavations at the beginning and end terminals staging points of the horizontal bore-hole.
 - d. Provide full depth "shoring" of the vertical pilot excavations. Remove the shoring, backfill, compact, and repair the excavations when conduit installation is complete.
 - e. "Drilling-fluid" shall be used during "back-reaming" and "pullback", pumped through the drill pipe to the bore drill head.
 - f. Directional guided horizontal drilling shall employ equipment specifically designed and manufactured for the process. The Equipment Manufacturer shall train Bore Equipment Operating Personnel in the proper operation of said equipment.
 - g. Locate the position, size, depth and identify all underground "cross-bore" existing underground utilities, pipes, structures, and conflicts along the entire bore path of each underground bore, prior to initiating directional boring work. Notify respective Agency for each "cross bore" potential crossing. Comply with the recommendations of the Cross-Bore Safety Association (CBSA).
 - h. Horizontal, directionally guided boring equipment, as manufactured by Ditch Witch; Vermeer Manufacturing; or Case Corporation.
- J. Conduit Seals
- 1. Provide conduit seal fittings at each location where a conduit transitions or passes through the following areas and where indicated on the Drawings:
 - a. Refrigerated areas.

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- b. Temperature control rooms including warming rooms, steam rooms, saunas etc.
 - c. Classified hazardous material areas.
 - d. Water intrusion areas.
 - 2. Provide conduit seals on each conduit entering a building from a below grade area located outside the building (i.e., basement, vault etc.) and connecting to the following types of equipment
 - a. Transformers
 - b. Panelboards
 - c. Motor control centers
 - d. Switchboards
 - e. Switchgear
 - f. Motors
 - g. Terminal cabinets
 - h. Terminal backboards
 - i. Cable trenches
 - 3. Conduit seals shall be installed in locations where the fitting is visible and accessible.
- K. Nailing Shields
 - 1. Provide "nail" shields where FMC conduit and conductors not installed in a conduit are installed through wood stud and wood frame construction. The nail shield shall provide a barrier resistant to "nailing" fasteners through the stud and penetrating into the FMC and conductors.
 - 2. The nail shields shall be flat nominal 1.5-inch by 3-inches, 14-gauge steel, and hot dip zinc galvanized with "nailing spurs".
 - 3. Provide nailing shields on the front face and rear face of each FMC penetration. The shield shall be centered on each penetration through the respective framing, stud framing blocking, and stud framing plates.
- L. Conduit Bodies
 - 1. Conduit bodies shall be installed in exposed conduit locations only or above accessible ceilings.
 - 2. Conduit bodies shall be accessible for removing body cover and pulling wire through the conduit body.
 - 3. Conduit bodies shall not be installed inside enclosed walls.
- M. Preparation of Reuse of Existing Conduits
 - 1. Prepare existing conduits shown to be reused as part of Contract Work as follows: Complete the required work prior to installing any conductors or cables in respective existing conduits.
 - a. "Rod" out existing raceways to be used under this contract, with approved test and flexible mandrels to remove all obstructions to clear debris from inside conduits.
 - b. Use test mandrels at least 12-inches long, 0.25-inch less than diameter of duct at center, tapering to 0.5-inch less than duct size at ends.
 - 2. If test mandrels cannot be pulled through raceways, Contractor shall perform the following to clear the existing raceways:
 - a. Force rigid or semi-rigid rods through the raceways to clear the obstructions from one to both ends of the raceway.
 - b. Force a power-driven rotating router device through the conduit from one or both ends of raceways. Device shall incorporate small diameter cutting blades. Repeat the "router" process in incremental stages to a

cutting blade diameter approximately 1/8-inch smaller than the raceway inside diameter.

3. After clearing the raceway of obstructions, pull a test mandrel or brush through the raceway to clear the remaining debris from the raceway.

3.04 WIRE AND CABLE

- A. Branch circuit and fixture joints for #10AWG and smaller wire shall be made with UL-approved connectors listed for 600 volts, approved for use with copper and/or aluminum wire. Connector to consist of a cone-shaped, expandable coil spring insert, insulated with a nylon shell and two wings placed opposite each other to serve as a built-in wrench or shall be molded one-piece as manufactured by 3M- "Scotchlok".
- B. Branch circuit joints of #8AWG and larger shall be made with screw pressure connectors made of high strength structural aluminum alloy and UL-approved for use with both copper and/or aluminum wire as manufactured by Thomas & Betts. Joints shall be insulated with plastic splicing tape, tapered half-lapped and at least the thickness equivalent to 1.5-times the conductor insulation. Tapes shall be fresh and of quality equal to Scotch.
- C. Use UL listed pulling compound for installation of conductors in conduits.
- D. Correspond each circuit to the branch number indicated on the panel schedule shown on the Drawings except where departures are approved by the District's Representative or the District's Representative.
- E. All wiring, including low voltage, shall be installed in conduit.
- F. Control wiring to conform to the wiring diagrams shown on the Mechanical Drawings and the Manufacturer's Wiring Diagrams.
- G. All splices in exterior pull boxes and light poles shall be cast resins encapsulated.
 1. Power conductor splices - 3M Scotchcast Series 82/85/90; Plymouth or equal.
 2. Control and signal circuits 3M Scotchcast Series 8981 through 8986, Plymouth or equal.
- H. Neatly group and lace all wiring in panelboards, motor control centers and terminal cabinets with plastic ties at 3-inch on centers. Tag all spare conductors.

3.05 CHEMICAL GROUND ROD

- A. General
 1. Install ground rod system in compliance with Manufacturer's instructions.
 2. Install rods vertically. Where subterranean hard rock conditions prevent vertical installation horizontal "L" shape ground rod shall be installed.
 3. Where ground rod is installed in an indoors dry location set ground box flush with finish floor. Where ground rod is installed outdoors set the top of the ground box four inches above finish grade.
 4. Do not remove sealing tape from ground rod holes until time of installation in ground.
 5. Separate ground rods from all other grounding electrodes and from each other by not less than 12-feet horizontal distance.

- B. Excavation
 - 1. Vertical installation bore a 12-inches diameter vertical hole in the ground 6-inches deeper than ground rod length.
 - 2. Horizontal installations excavate a 12-inches wide trench, slope rod and trench to ensure end cap of rod is 2-inches lower than the elbow.
- C. Backfill
 - 1. Surround the entire rod with a minimum of 10 inches of bentonite clay mixed with water at six times volume to form a paste. Approximately 14-gallons for each 50-pounds of clay. Remove any excavation liners from the rod excavation area.
 - 2. Install ground box and complete backfill.
- D. Connect grounding electrode conductor(s) to ground rod.

3.06 CABLE RACKS

- A. General
 - 1. Provide cable racks in precast and cast-in place concrete pullboxes, manholes and cable trenches.

3.07 TESTING

- A. Testing Conduit and Conduit Bends

The Contractor shall demonstrate the usability of all underground raceways, and field fabricated conduit bends installed as part of this Contract.

 - 1. A round tapered segmented semi-rigid mandrel with a diameter approximately ¼-inch smaller than the diameter of the raceway shall be pulled through each new raceway.
 - 2. The mandrel shall be pulled through after the raceway installation is completed. Conduits which stubout only, may have the mandrel pulled after the concrete encasement is completed, but prior to completing the backfill.
 - 3. District's Representative shall witness the raceway testing for usability. A Representative of the respective Utility Company shall witness the raceway testing where applicable.
 - 4. Contractor shall repair/replace any conduit and conduit bend provided under this Contract which will not readily pass the mandrel during this test.

**END OF SECTION 26 0530
10132/223099**

SECTION 26 2416

BRANCH CIRCUIT PANELBOARDS AND TERMINAL CABINETS

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
 - 2. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Provide Manufacturers catalog data for panels, cabinets, and circuit breakers.
- B. Provide Shop Drawing showing panel circuit arrangements, size, voltage, ampacity, over-current protective devices, etc.
- C. Provide Nameplate Engraving Schedule.
- D. Short Circuit, Coordination and Arc-Flash
 - 1. Perform and submit engineered settings for each equipment location, fuse and adjustable circuit breaker device, showing the correct time and settings to provide the selective coordination within the limits of the specified equipment, per the latest applicable standards of IEEE and ANSI. Provide electrical system short circuit fault analysis, both 3-phase line-to-line and 1-phase line-to-ground calculations as part of the Coordination Analysis recommendations. Provide Electric Arc-Flash calculations as part of the Coordination Analysis recommendations.
 - 2. The information shall be submitted in both tabular form and on time current log-log graph paper, with an Engineering Narrative. Written narrative describing data, assumptions, analysis of results and prioritized recommendations, six copies.
 - 3. The goal is to minimize an unexpected but necessary electrical system outage and Personnel exposure to the smallest extent possible within the fault occurrence location, using the specified Contract Equipment. Shall comply with, but not limited to:
 - a. IEEE-242, Recommended Practices for Protection and Coordination of Industrial and Commercial Distribution.
 - b. IEEE-399, Recommended Practice for Industrial and Commercial Power System Analysis.
 - c. IEEE-1584, Guide to Performing Arc-Flash Hazard Calculations.
 - d. CEC/NEC
 - 4. Electrical equipment including switchgear, switchboards, electrical panels, and control panels, transformers, disconnects, etc., shall each be labeled by the Manufacturer with "Electrical-Arc-Flash" warning signs. The signs shall explain a hazard to Personnel may exist if the equipment is worked on while energized

- or operated by Personnel, to wear the correct Protective Equipment/clothing (PPE) when working "Live", or operating "Live" equipment and circuits.
5. The Contractor shall independently contact the serving Utility Company to obtain the current system short circuit amps or available fault current.
 6. The Contractor shall independently obtain As-Built Drawings for the existing infrastructure to establish lengths. If As-Built Drawings are no available, the Contractor shall research existing conditions and make reasonable but conservative estimates of conductor length. Where existing conductors have been re-used, the Contractor shall confirm conductor quantity, size, and conduit type.
- E. Provide submittal for Test Plan sequence, procedures, tester qualifications and blank test forms. Provide submittal report of test results for review and approval.

1.03 SEISMIC EARTHQUAKE AND WIND LOADING WITHSTAND, TESTING AND CERTIFICATION (ADDITIONAL REQUIREMENTS)

- A. General
1. The complete panels and terminal cabinet assemblies; including circuit protection devices, meter, housings/enclosures, accessories, supports/anchors etc., shall be designed, manufactured and tested.
 - a. Wind loading all outdoor equipment locations.
 - b. Earthquake Seismic and CBC/IBC Seismic withstand all indoor and all outdoor equipment locations.
 2. Shall withstand, survive, and maintain continuous non-interrupted energized operation during the seismic event occurrences and wind event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
 3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation. Acceptance test seismic qualification shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.
 4. Provide three-dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading not less than as follows and as required by AHJ:
 - a. 110MPH – West Coast States USA and Hawaii per ASCE/SEI 7-16.
 5. Seismic test shall be performed by a third-party independent Test Laboratory. Wind Analysis and Seismic Testing and Reports shall be certified, signed, and "Stamped" by PE Professional Engineer Licensed and in good standing in the State, Civil Engineer or Structural Engineer.

PART 2 - PRODUCTS

2.01 PANELBOARDS AND DISTRIBUTION PANELS

- A. Shall be flush or surface mounting as indicated with group-mount circuit protection devices as shown on panel schedule, hinged lockable doors, index cardholders and proper bussing.
1. Panelboards shall comply with the latest versions:
 - a. NEMA – PB1.
 - b. UL – 50 and 67.
 - c. CEC/NEC.

- d. ASTM-B187.
- 2. Where indicated on the Drawings shall be furnished with subfeed breakers and/or additional conductor lugs, split bussing, contactors, time switches, relays, etc., as required.
 - a. Branch circuit panels up through 42-circuits shall be single Section, to accommodate all the circuits and components.
 - b. Distribution panels shall be single Section or Multi-Section, to accommodate all the circuits and components.
- 3. Panels shall be "Service-Entrance" equipment rated when the panel main incoming supply feeder originates from one of the following:
 - a. Originates outdoors exterior of the building in which the respective panel is located.
 - b. Originates from an electrical supply source not located in the same building as the respective panel.
- B. Housing and Painting, Panels and Terminal Cabinets
 - 1. Shall be finished with one coat of rust inhibitor zinc chromate and coat of primer sealer after a thorough cleaning.
 - 2. Finish color paint as selected by District's Representative where exposed to public view (e.g., corridors, covered passages, offices, etc.). Prime coated panelboard shall be painted to match surroundings after installation in public areas.
 - 3. Manufacturer's Standard color in electrical rooms/closets, janitors, HVAC, and storage rooms.
 - 4. Shall be fabricated of sheet steel of the following minimum gauges.
 - a. Full height hinged, locking door. Trim #12-gauge steel; enclosure - code gauge steel.
 - b. Panels installed in indoor dedicated electrical equipment rooms and dedicated electrical equipment closets, omit full height hinged locking panel door. Dead front cover behind omitted panel door shall remain.
 - 5. NEMA-1 Metal Housing, for indoor locations.
 - 6. NEMA-3R Metal Housing, tamper resistant, for outdoor locations.
 - 7. Furnish all panels and terminal cabinets with the Manufacturers flush locks and keys except where indicated otherwise herein. Keys and locks shall be interchangeable for all panels. Provide two latches and two locks for door heights exceeding 36-inches.
 - 8. Fasten the trim to panel and terminal cabinets by means of concealed, bolted, or screwed fasteners accessible only when the door is open.
- C. Panels 480/277 and 208/120 volt, 3-phase, 4-wire, S/N or 120/240-volt, single phase, 3-wire, S/N.
 - 1. Branch Circuit panel as manufactured by:
 - a. Square D "NF/NQ" Series
 - b. Eaton
 - 2. Distribution Panels as manufactured by:
 - a. Square D "I-Line" Series
 - b. Eaton
- D. Top and bottom gutter space shall not be less than 6-inches high. Provide 6-inches additional gutter space in all panels where double lugs are required, or where cable ampere size exceeds bus ampere size. Provide 12-inches additional gutter space in all panels for aluminum feeders where used.

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- E. Panel Dimensions.
 - 1. Panels with buss sizes 50-amp thru 400-amp.
 - a. Shall be 20-inches wide. Surface or flush mounting as indicated.
 - b. Recess mounted type shall have a 20-inches wide (maximum) recess metal enclosure with overlapping edge trim plate cover extending 1-inch on all sides of enclosure.
 - c. Depth shall be 5.75-inches nominal. Height of panel as required for devices.
 - 2. Panels with buss sizes greater than 400 amp.
 - a. Narrow panels 24-inches (maximum) wide by 6.5-inches (maximum) deep units. Wide panels 25-inches to 44-inches (maximum) wide by 8-inches to 15-inches (maximum) deep units. Nominal 90-inch panel height.
 - b. The wider units shall be used only at locations where the narrow unit is not available with the quantity or size of large-ampere frame branch/subfeed circuit protective devices shown on the panel schedules, or where the main breaker size exceeds the narrow panel maximum.
 - c. Distribution panels shall be floor standing and supported from behind the panels at walls.
- F. Distribution Panels and Branch Circuit Panels Maximum Load Rating
 - 1. Panelboards and Distribution Panels exceeding 800-amp load rating shall not be permitted.
 - 2. Provide Distribution Switchboards instead of Distribution Panels for bus load and circuit load ratings exceeding 800-amp.
- G. Panel Auxiliary Cabinets
 - 1. Panelboards shown on the Drawings with relays, time clocks or other control devices shall have a separate auxiliary metal barrier compartment mounted above panel.
 - 2. Panelboards with circuits controlled by low voltage remote control relays shall be provided with separate auxiliary cabinets to contain the relays, adjacent to the panelboard.
 - 3. Provide auxiliary cabinets with separate hinged locking door to match panel-board.
 - 4. Provide mounting subbase in cabinet for control devices and wiring terminal strips.
- H. Panels shall have a circuit index cardholder removable type, with clear plastic cover. Index card shall have circuit numbers imprinted to match circuit breaker numbers.
 - 1. The panel identification nameplate shall describe the respective panel name and voltage, corresponding to the Contract Documents.
 - 2. The electrical power source, name and location of each panel supply-feeder and supply equipment name shall also be identified and described on the respective panel nameplate.
- I. SPD – Surge Protection Device
 - 1. Provide each of the following branch circuit panel and distribution panel types with an SPD and RF filtering:
 - a. 208/120 volt - single phase and/or three-phase.
 - b. 120/240 volt - single phase.
 - c. 480/277 volt - single phase and/or three-phase.
 - d. All distribution panels.

2. The SPD shall be installed inside the respective panel housing and shall be factory connected to each main phase, ground, and neutral bus inside the panel.
 3. The SPD monitor/annunciator indicators shall be visible only when the panel access door is in the open position.
 4. Provide a 20-amp 3-pole (2-pole for single-phase panels) branch circuit protection device in each panel for SPD connection.
 5. The SPD and panel shall be UL labeled and listed for combined use. See related Specification Sections for additional SPD Requirements.
- J. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements)
1. The complete panel/panelboard assembly; including circuit protection devices, housings/enclosures, accessories, supports/anchors etc., shall be designed, manufactured, and tested for Wind Loading and Earthquake Seismic Withstand.
 2. Shall Withstand, survive, and maintain continuous non-interrupted energized operation (running) during the seismic event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
 3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation.
 4. Provide three-dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading as follows:
 - a. 110MPH – West Coast States USA and Hawaii, per ASCE/SEI 7-16.
 5. Acceptance Test Seismic Qualification of proposed panels and panelboards shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.
 6. Seismic test shall be performed by a third-party independent test laboratory. Wind Analysis and Seismic Testing and Reports shall be certified, signed and “Stamped” by PE Professional Engineer Licensed and in good standing in the State, Civil Engineer or Structural Engineer.

2.02 SHORT CIRCUIT RATING

- A. Circuit protective devices and bussing as indicated on the Drawings. All devices and bussing shall have a short circuit fault withstand and interrupting capacity not less than the maximum available fault current at the panel and as indicated on the Drawings, plus a 25% additional capacity (safety margin). However, in no case shall the short circuit fault interrupting and withstand capacity be less than the following symmetrical short circuit.

	<u>C/B and/or Bus Rating</u>	<u>Circuit Voltage</u>	<u>Short Circuit Amp.</u>
1.	400A and less	240V and below	10,000A
2.	400A and less	over 240V and below 600V	14,000A
3.	Over 400A & 800A & below	240V and below	42,000A
4.	Over 400A & 800A & below	over 240V and below 600V	30,000A

- B. Panel Short Circuit Fault Rating
1. General
 - a. Provide a “fully rated” for short circuit fault interrupt and full load ampere main circuit breaker in each branch circuit panel and/or each distribution panel. Provide the main circuit breaker whether or not a main circuit breaker is shown otherwise on the Drawings, Schedules or Diagrams.

- The “utility-source” plus the “motor-load” transient contributions shall be used to establish the available fault duty values, unless indicated otherwise on the Drawings.
- b. The panel main circuit breaker full load ampere capacity rating shall equal the respective panel main bus ampere rating.
 - c. The panel assembly, buss and circuit protection devices bolted fault short circuit withstand and bolted fault short circuit interrupt ratings shall not be less than 125% greater (including a 25% safety margin) than the available utility-source symmetrical and asymmetrical bolted fault short circuit current when “Series Combined Rated” with the panel main circuit breaker.
 - d. The main circuit breaker rated “bolted-fault” short circuit fault interrupt and withstand short circuit rating shall not be less than 125% (including a 25% safety margin) of the upstream main service entrance “bolted-fault” available (symmetrical and asymmetrical) short circuit current.
2. Distribution Panelboards
- a. Distribution panel, main circuit breaker, all feeder circuit breakers, and all branch circuit breakers shall be “fully-rated” (plus safety margin) for the available bolted fault short circuit current (including safety margin).
 - b. Shall provide time/current-tripping coordination with downstream equipment and upstream equipment.
3. Non-emergency branch circuit panelboards 400-amp buss and smaller; Non-emergency branch circuit panelboards 400-amp trip main circuit breaker and smaller.
- a. The branch circuit panel main circuit breaker shall be “fully-rated” (plus safety margin) Current Limiting Circuit Breaker type (CLCB). Shall provide time/current- tripping coordination with upstream equipment.
 - b. The branch circuit panel main circuit breaker shall be “series-rated” with the panel downstream branch circuit devices and panel bussing. “The series-rating” shall provide short circuit bolted fault current withstand protection and short circuit bolted fault interrupt rating protection during a downstream 3-phase line-to-line and/or single-phase line-to-ground short circuit bolted faults.
 - c. Typical for branch circuit panelboards connected to normal-power (non-emergency) power circuits.
4. Emergency branch circuit panelboards 400-amp bus and smaller; Emergency branch circuit panelboards 400-amp trip main circuit breaker and smaller.
- a. The branch circuit panel main circuit breaker shall be short circuit bolted fault “fully-rated” (plus safety margin) Non-Current Limiting Circuit Breaker type (non-CLCB).
 - b. The panel bussing shall also be short circuit bolted fault “fully-rated”.
 - c. All of the branch circuit panel, branch circuit breakers shall be “fully-rated” Non-fused Current Limiting Circuit Breaker Type (CLCB). Shall provide short circuit bolted fault interrupt rating. Coordinated time/current and instantaneous tripping with the upstream circuit protection devices.
 - d. Typical for branch circuit panelboards connected to emergency power circuits.

2.03 PANEL CIRCUIT BREAKERS, CIRCUIT PROTECTION DEVICES

- A. Circuit Breakers General, for Distribution Panels and Panelboards
 - 1. NEMA-AB1 and AB3, comply with latest revision.
 - 2. UL-1087, UL-489 and IEC-60.947.2 rated devices, comply with latest revision.

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3. 5Hz AC closing and 3Hz AC trip and clear.
 4. Main circuit breakers for distribution panels exceeding 400 amp and larger.
 - a. Shall be Insulated Case Circuit Breaker type (ICCB).
 5. Main circuit breakers for branch circuit panelboards 400-amp buss and smaller.
 - a. Shall be Current Limiting Circuit Breaker type (CLCB) for non-emergency panelboards.
 - b. Shall be Molded Case Circuit Breaker type (MCCB) for emergency panelboards.
 6. Branch circuit breakers and feeder circuit breakers smaller than 100-amp trip shall be Molded Case Circuit Breakers type (MCCB) and/or Current Limiting Circuit Breakers type (CLCB).
 7. All circuit breakers 100 amp and larger trip shall employ sensors and solid state digital electronic automatic trip system. Short-time and long-time time/current curve shaping field adjustable functions and adjustable instantaneous trip. Typical for Molded Case Circuit Breaker type (MCCB), Insulated Case Circuit Breaker type (ICCB) and Current Limiting Circuit Breaker type (CLCB).
- B. Manufacturer
1. Circuit breakers as manufactured by the following Companies only are acceptable:
 - a. Square D Co.
 - b. Eaton
- C. Configuration
1. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the Drawings.
 2. Circuit numbers of breakers shall be black-on-white micarta tabs or other previously approved method. Circuit number tabs, which can readily be changed from front of panel, will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.
 3. Panelboard circuit protection devices shall be bolt on type for connection to panel bus. Removable and installable without disturbing adjacent devices.
 4. Provide conductor wire terminations (lugs) on each circuit protection device for incoming main feeder, branch circuits and outgoing feeder circuits. Dual rated copper/aluminum and compatible with the respective conductor size, type, and quantity.
 5. Where 2-pole or 3-pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.
 6. Branch circuit panels shall be field convertible for bottom entry main incoming feeder or top entry main incoming feeder.
 7. Each Panel Section, the feeder and branch circuit protection devices (3-phase and/or 1-phase) shall be "twin-mount", side-by-side double row construction for the following circuit sizes:
 - a. 480/277 volt, 60-amp circuit size and smaller.
 - b. 240 volt – 208/120-volt, 100-amp circuit size and smaller.
- D. Lock-Off and Lock-On
1. All circuit breakers shall be pad-lockable in the "off" position.
 2. Where branch circuit breakers supply the power to motors and signal systems, the breakers shall also be furnished with lockout clips, mounted in the "on" position. The breakers shall be able to trip automatically with lockout clips in place.

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3. Provide lock-on clips on branch circuit breakers supplying fire alarm equipment and fire alarm panels. Provide identification of the dedicated "fire alarm" circuit function and operation. Color-code the circuit breakers to comply with AHJ Requirements.
 4. Locking facilities shall be riveted or mechanically attached to the circuit breaker (submit sample for approval. Other means of attachment shall not be accepted without prior written approval of the District's Representative.
- E. ARC Fault Interrupter Circuit Breaker (AFCI-C/B)
1. AFCI-C/B provides automatic circuit interruption upon detection of any of these conditions: overload, short circuit fault and electric branch circuit arcing protection.
 2. The AFCI-C/B shall detect intermittent "arcing" type electrical faults and provide automatic circuit interruption (tripping).
 3. Provide "test-pushbutton" on each C/B for manual AFCI-C/B testing.
 4. Single pole, 120-volt, 60Hz AC UL listed and labeled for installation in panel-board, #14 - #8AWG solid/stranded AL/CU load conductor.
- F. Switch and Fuse Feeder Protective Devices for Distribution Panels
1. Locations where the Drawings show distribution panels employing switch-fuse circuit protection devices.
 2. Fusible Switches: Quick-make, quick-break type with rejection clips for use with Class "R" fuses Current Limiting Fuses (CLF). Switches with ratings up to and including 100-amp at 240 volts shall be twins mounted. Switches rated through 60-amp and 480-volts shall be twins mounted. Provisions for padlocking in the "on" and/or "off" positions. Switches shall be removable from front of panel without disturbing adjacent units or panel bus structure.
 3. Fuses shall be time delay current limiting types, UL Class RK-1 unless otherwise indicated on the Drawings. Provide one spare set of fuses of each size and type in each Distribution Panel.
 4. Provide auxiliary contact on switch for remote status (on-off) signaling and monitoring. Provide conductor lugs to accept conductor temperature rating, sizes and quantities shown on Drawings.
 5. Switch and fuse devices shall be permitted only in distribution panels and only where specifically indicated on the Drawings for feeders.

2.04 PANEL BUSSING

- A. Bus Material
1. Bussing shall be rectangular cross section tin-plated copper or alternately silver or tin-plated aluminum.
 2. Bussing shall be non-tapped, full length of the enclosure.
- B. Ground Bus
1. Each panel shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.
- C. Provisions
1. Provide space and all hardware and bus mounting attachments for future devices as indicated on the Drawings.

D. Neutral Bus

1. The ampere rating of the neutral bus of panels and distribution panels shall be a minimum of 100% greater ampere capacity than the ampere rating of the corresponding phase bus, where the panel is indicated to be provided with an "oversize-neutral" or "200%" neutral on the Drawings.

2.05 TERMINAL AND AUXILIARY CABINETS

A. Cabinets

1. Fabricated of Code gauge sheet steel for flush mounting (except where noted as surface) of size indicated on the Drawings, and complete with hinged lockable doors, provide the quantity of 2-way Feed through conductor terminals required for termination of all conductors, plus 15% spares of each type.
2. Cabinet locks to operate from same key used for panelboards. The trim to cabinets shall be fastened by means of concealed bolted or screwed fasteners accessible behind door into cabinets. All cabinets shall have $\frac{5}{8}$ -inch plywood backing, finished with fireproof intumescent primer and finish coat paint. Provide equipment ground bus in each cabinet.
3. Cabinets shall be finished with one coat of zinc chromate and one coat of primer sealer after a thorough cleaning. Where exposed to public view (e.g., corridors, covered passages, offices, etc.) finish color paint to match surrounding and Manufacturer's standard gray color in switchboard, janitors, heater, and storage rooms.
4. Provide grounded metal barriers inside cabinet to isolate and separate line voltage and low voltage from each other inside the cabinet.

B. Cabinet Dimensions.

1. Unless indicated otherwise on Drawings.
 - a. Shall be 20-inches wide. Surface or flush mounting as indicated.
 - b. Recess mounted type shall have a 20-inches wide (maximum) recess metal enclosure with overlapping edge trim plate cover extending 1-inch on all sides of enclosure.
2. Depth shall be 5.75-inches nominal. Height of cabinet as required for devices, plus 25% spare unused interior space for future use, but not less than 36-inches high.

C. Terminals

1. Non-digital analog circuits; line and low voltage modular signal systems, 15-amp dual row with isolation barriers, screw-down terminals insulated strips, heavy duty.
 - a. As manufactured by Molex, or ITT-Cannon, or General Electric.
2. Digital circuits; low voltage signal systems, ANSI/EIA/TIA Category-6, 110-Block or 66-Block gas-tight punch down style, heavy duty.
 - a. As manufactured by Leviton, or Ortronics, or AMP.

D. Identification (Additional Requirements)

1. Provide engraved nameplate on each cabinet indicating its designation and system (i.e., "Life Safety System - Panel 2LS", etc.).
2. Identify each terminal landing with unique circuit number and provide corresponding alphanumeric text-index card inside panel access door

PART 3 - EXECUTION

3.01 MOUNTING

- A. Flush Mounted Panelboards and Terminal Cabinets shall be securely fastened to at least two studs or structural members. Trim shall be flush with finished surface.
 - 1. Panels and cabinets installed flush (recess or semi-recess) into fire rated or smoke rated walls. The wall recess shall be fully wrapped inside the recess with fire/smoke rated materials. The wrap-materials shall provide the same fire and/or smoke protection rating as the respective wall.
- B. Surface Mounted Panels and Terminal Cabinets shall be secured to walls by means of preformed galvanized steel channels securely fastened to at least two studs or structural members.
- C. Panelboards and Terminal Cabinets shall be installed to insure the top circuit protective device (including top compartment control devices) are not more than 6-feet-6-inches above finish floor in front of the panel and the bottom device is a minimum of 12-inches above the floor. Manufacturer shall specifically indicate on Shop Drawing submittals each panel where these conditions cannot be met.

3.02 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

- A. Provide a red and white Bakelite nameplate with ½-inch high letters in each 277/480 volt panel fastened to face of dead-front plate, to read: "DANGER 480 (or as applicable) VOLTS KEEP OUT AUTHORIZED PERSONNEL ONLY".
- B. Manufacturer shall stencil the panel/cabinet number identification on the inside of door to correspond with the designation on the Drawings.
- C. Identification Plates and Numbers shall be attached with screws or twist lock fasteners. Adhesive attachment of any kind shall not be used.

3.03 SPARE CONDUITS (ADDITIONAL REQUIREMENTS)

Provide three 1-inch conduit only stubs from each panel and terminal cabinet into accessible ceiling space. Where floor level below panel or terminal cabinet is accessible, also provide an additional three 1-inch conduit only stubs into accessible floor space.

END OF SECTION 26 2416
101320/223099

SECTION 26 5213

EMERGENCY LIGHTING CENTRAL BATTERY

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
 - 2. General Provisions and Requirements for electrical work.
- B. Demonstration and Instruction (Additional Requirements)
 - 1. Provide on-site instruction classes and operation manuals to the District's Personnel.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. General
 - 1. Submit Manufacturer product data, dimensional data, ambient environmental data and derating factors, electrical performance data.
 - 2. Submit performance and technical information on battery calculations and/or factory tests demonstrating capacity capabilities.

1.03 APPLICABLE STANDARDS (ADDITIONAL REQUIREMENTS)

- A. General
 - 1. The equipment shall be listed, labeled, and approved for the application show in the Contract Documents, as a battery stored energy, emergency lighting electrical power inverter, complying with the most recent version of the following Applicable Standards. These Standards shall become Requirements of Contract Document and included in the Contract Documents.
 - a. Underwriters Laboratory – UL
 - 1) UL – 924 and 924A Standard for Emergency Lighting and Power Equipment.
 - 2) UL – 1778 Standard for Uninterruptible Power Supply Equipment.
 - b. National Fire Protection Agency – NFPA
 - 1) NFPA – 111 Stored Electrical Energy and Standby Power systems.
 - 2) NFPA – 70 Article 700 Emergency Systems. (NEC) Article 480 Storage Batteries.
 - c. Federal Communications Commission – FCC
 - 1) FCC - Class A RFI emission limits.
 - d. American National Standards Institute – ANSI
 - 1) ANSI – C62.41 both Category-A and Category-B and C62.45 Transient Voltage Withstand.
 - e. Institute of Electrical and Electronic Engineers – IEEE
 - 1) IEEE – 587 Surge Voltages

- B. Seismic Earthquake and Wind Loading Withstand, Testing and Certification (Additional Requirements).
 - 1. The complete emergency lighting central battery inverter assembly; including circuit protection devices, meter, housings/enclosures, batteries, accessories, supports/anchors etc., shall be designed, manufactured, and tested.
 - a. Wind loading all outdoor equipment locations.
 - b. Earthquake Seismic Requirements of CBC/IBC Seismic withstand all indoor and all outdoor equipment locations.
 - 2. Shall withstand, survive, and maintain continuous non-interrupted energized operation during the seismic event occurrences and wind event occurrences. Continued normal energized operation after the wind event and seismic event occurrences have abated.
 - 3. Shall include demonstrations of successful operation and run test after completion of seismic event shake-table simulation. Acceptance Test Seismic Qualification of proposed equipment shall employ triple axis shake-table simulation of the Required Response Spectrum (RRS) seismic event motion, certified and approved by the AHJ.
 - 4. Provide three-dimensional finite element analysis demonstrating anchorage and operational withstand of wind loading not less than as follows and as required by AHJ:
 - a. 110MPH-West Coast States USA, California, and Hawaii, per ASCE/SEI 7-16.
 - 5. Seismic test shall be performed by a third-party independent Test Laboratory, shall include batteries. Wind analysis and Seismic Testing and Reports shall be certified, signed, and "stamped" by PE Professional Engineer licensed and in good standing in the State, Civil Engineer or Structural Engineer.
- C. Short Circuit, Coordination and Arc-Flash (Additional Requirements)
 - 1. Perform and submit short circuit fault current, time/current Coordination and ARC-Flash fault engineering analysis, for AC and DC circuits.
 - 2. Provide label equipment with warning and instructional signs.

PART 2 - PRODUCTS

2.01 OPERATION

- A General
 - 1. The Emergency Lighting Battery Unit (ELBU) shall be self-contained, automatic operation. Unit shall store electrical energy and supply standby back-up electrical energy upon failure of normal (utility source) power and provide operation of lighting and other connected equipment as described in the Contract Documents.
 - 2. ELBU shall consist of an automatic circuit transfer system, input/output circuits, storage batteries, battery charger, voltage inverters, monitoring, test/monitoring equipment and operating program software. Manufactured with all components enclosed in modular cabinetry.
 - 3. ELBU volt-ampere continuous load rating shall be sufficient to provide operation of the full unit rated load. But in no case less, than required to supply all the connected loads shown on the Drawings, plus an additional 20% spare continuous load capacity "Safety Factor". All at an 80% (0.80) lagging load power factor.
 - a. Normal mode load capacity operation duration shall be continuous.

- b. Emergency mode full 100% rated load capacity operation shall be for the duration time indicated on the Drawings, but not less than 90 continuous minutes.
4. Unit shall operate properly in ambient temperatures from 15 to 25 degrees centigrade, sea level to 10,000 feet above sea level, at the specified ratings.
5. Emergency lighting central battery unit shall be as manufactured by Dual-Lite, or Myers Power Products.

B. Operation

1. During operation under normal mode 60Hz AC power, the supply voltage shall feed both the output load and the battery charger. Upon normal power failure, the output load shall be automatically transferred to internal 60Hz AC emergency mode power operation.
2. When normal power is re-established, the output load shall be automatically transferred back to the normal power AC line and the charger shall commence recharging the batteries to their full capacity.
3. Transfer to emergency mode operation shall occur when normal input voltage drops to less than 60% to 70% of nominal for brownout protection on any input line phase. The transfer to emergency mode shall also occur if there is an open circuit, or shorted circuit on the normal input side. A 15 to 60-second transfer time delay (nominal) back to normal mode operation shall be adjustable to reduce "cycling" operation between normal and emergency operating modes.

2.02 LOAD REQUIREMENTS

A. Load Types

1. Load output shall be provided for the following types of loads in any loading combination (0 to 100% of load rating), within the rated capacity (0 to 100% of load rating) for 50% (0.5) lag through 50% (1.5) lead load power factors.
2. Unit shall be suitable for operation and withstand inrush currents associated with the connected loads without damage or changes in its operation including:
 - a. Incandescent lamps and ballasts.
 - b. Fluorescent lighting fixtures and ballasts.
 - c. Electronic equipment including fire alarm equipment.
 - d. High Intensity Discharge (H.I.D.) lighting fixtures and ballasts (continuous ARC-sustain operation).
 - e. Solid state electronic lighting fixture ballasts and dimmers.
 - f. Electromagnetic lighting fixture ballasts and dimmers.
 - g. LED (Light Emitting Diode) solid-state lamps and drivers.
 - h. Fire door holds open devices.

B. Voltage

1. Normal power input and output voltage shall be 60Hz, AC single phase or three-phase; 120-volt; 208-volt; 240-volt; 277-volt; 120/208 volt 3 wire or 120/240 volt 3 wire. All as indicated on the Drawings.
2. Provide multiple load output voltages, for both normally on and normally off loads, where indicated on the Drawings (i.e., 120-volt input - 120 volt and 277-volt load output; 277-volt input 120-volt and 277-volt output; etc.).
3. The total line input volt-amperes shall not exceed 135% of the unit rated full load output volt amperes and output line voltage, including battery-recharging loads.

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- C. Circuit Breakers Line and Load
 - 1. Provide load output circuit breakers, ampacity and quantity as indicated on the Drawings, but in no case less than one 20-amp load output circuit breaker for each 1500-volt ampere (or portion thereof) of unit rated load capacity. Provide the circuit breakers on each normally off and each normally on load out connection and on each load out voltage connection.
 - 2. Provide a unit main line input circuit breaker in the ELBU. The circuit breaker shall be sized to allow continuous full rated load operation of the ELBU, including battery-recharging loads.
 - 3. Provide D.C. battery protection internal breakers.
 - 4. The circuit breakers shall be thermal magnetic molded case type. The Main line input circuit breaker shall be rated a minimum of 42,000-amp symmetrical short circuit interrupting capacity, but not less than shown on the Drawings. Internal and load output circuit breakers shall be "series rated" or "fully rated" to the main input circuit breaker symmetrical short circuit interrupting capacity, at the specified input and output voltage(s).
 - 5. Monitor and trouble-alarm each circuit breaker for "tripped" or "off" condition.
- D. Load Output
 - 1. Provide output load types as follows (in any combinations up to unit full rated output capacity).
 - 2. Normally on - Output load is energized in both the normal and emergency modes.
 - 3. Normally off - Output load is energized only when unit is in the emergency mode and de-energized when the unit is in the normal mode.
 - 4. The unit shall function correctly with no load (zero-volt amp) connected to the output terminals. UNITS REQUIRING A MINIMUM CONNECT LOAD FOR CORRECT OPERATION ARE NOT ACCEPTABLE.
- E. Load Output Voltage Characteristics
 - 1. During the entire rated operation duration, output voltage shall be sinusoidal wave.
 - a. Total harmonic distortion shall not exceed 5% under any combination of the specified load conditions.
 - b. Voltage regulation shall not vary more than plus or minus 5% of rated voltage under all load conditions, no load 0% to 100% of full rated load.
 - 2. Load output voltage frequency regulation shall be within plus or minus 0.5Hz under specified load conditions, when operating on the inverter and batteries.
- F. Efficiency when Operating in Any Mode
 - 1. At 100% rated load – greater than 97%.
 - 2. At 50% rated load – greater than 94%.
 - 3. Efficiency shall be measured load output kW divided by the measured line input kW; with a connected load power factor of 0.8 lagging and the batteries fully charged operating on trickle float charge.
- G. Internal Bypass Switch
 - 1. Switch shall keep all the loads circuits energized while the ELBU is shut down (bypass) due to malfunction or maintenance.
 - 2. Three position switches: normal; unit bypass; loads off.

2.03 INVERTERS

- A. General
 - 1. Inverters shall be modular and completely solid state. Protected against overloads, in rush loads and short circuits.
 - 2. Inverter shall provide stable regulated output operation from the internal batteries under all specified load conditions.
 - 3. Low battery voltage cutout shall be provided to disconnect the inverter load when the battery output voltage drops below a preset value.
 - 4. Automatic unit restart after initiation and/or restoration of normal input power.

2.04 CONTROL, TESTING AND MONITORING EQUIPMENT

- A. Internal control, monitoring and testing with programming software and micro-processor control operation shall be provided to verify proper system operation and trouble conditions. Control, testing, and metering display panel shall be installed in the door of equipment cabinet not more than 6-feet-0-inches above finished floor.
- B. System Display/Control Panel
 - 1. The system's display panel shall include an array of visual indicators, multi-line alphanumeric character display, and a keypad to control and monitor the system.
 - 2. The array of visual indicators shall monitor and annunciate the AC utility presence, system ready status, battery charging status, battery emergency operation, and alarm functions.
 - 3. The system shall display alphanumeric meter functions including:
 - a. Input-voltage and input demand load.
 - b. Output-voltage, output-frequency, output-demand load, and output-power factor.
 - c. Unit internal component temperatures.
 - d. Total quantity of power outages and inverter operating time.
 - 4. To ensure only authorized Personnel can operate the unit, the system shall be password protected for all control functions, including parametric changes.
- C. Alarms
 - 1. The system shall have audible and alphanumeric visual alarm display, with automatic logging of the twenty most recent alarm events. Each alarm will have a corresponding audible signal associated with it to aid in the troubleshooting of the system.
 - 2. The system's alarm acknowledge feature shall enable the user to silence only the current audible alarm(s), while not silencing other alarms and not clearing the alarming condition until the fault has been cleared.
 - 3. Alarms shall monitor low, near low, and high battery voltage; high AC voltage input; high and low AC voltage output; volt-amp output overload; low runtime remaining; high ambient component temperature over limit; check charger, battery, inverter, and memory/logic; emergency power off activated; user test check; and call service.
 - 4. Alarms on each internal circuit breaker, to indicate when the circuit breaker is in the open/off/tripped positions.
- D. Manual and Programmable Testing
 - 1. The system shall provide both manual test functions and software programmable automatic test modes. The user shall be able to perform a system test at any time.

2. The system shall also perform an automatic programmable, weekly, self-diagnostic test and load test of its subsystems to ensure the system will operate in an emergency condition. A monthly load test for a user programmable discharge time and an annual test for a complete runtime discharge time and an annual test for a complete runtime discharge.
 3. Automatic recording in memory, of the last twenty inverter events, including all automatic weekly and user programmed tests, shall be logged.
- E. Remote Terminal Strip
1. An auxiliary terminal strip located within the system cabinet shall provide connection points for remote monitoring of inverter status and alarm indication.
 2. Remote monitor/annunciator panel:
 - a. Provide a remotely mounted ELBU monitoring/alarm panel, with operating status and alarm conditions visual and audible indicators. Provide an audible alarm silence push-button with automatic resound on subsequent alarms.
 - b. The panel shall be enclosed in a NEMA 1 for indoor locations, NEMA 3R for outdoor locations. Flush mounted housing, with "see-thru" front cover access door. Tamper resistant construction, suitable for installation in unsupervised public areas.
 - c. The remote monitoring and alarm panel shall operate over connecting circuit lengths up to not less than 300-foot distance from the respective ELBU.
 - d. Provide remote monitoring and alarm panels adjacent to each fire alarm annunciator panel unless noted otherwise on the Drawings.

2.05 BATTERIES

- A. General
1. Batteries shall provide capacity to operate the unit and maintain specified inverter out-put for indicated years on a pro-rata basis when properly maintained as recommended by the Manufacturer.
 2. Flame arresting caps shall be provided on batteries, with catalytic conversion to prevent hydrogen out gassing.
 3. Battery cases shall be translucent to allow visual observation of electrolyte level. Provide earthquake restraint battery mounting straps.
- B. Battery Seismic Restraint
1. Batteries shall be installed in the unit with seismic restraint anchors and straps.
- C. Battery Type
1. Batteries shall be nickel cadmium low maintenance type to reduce the need to replenish battery fluids. Batteries shall be 25-year design life expectancy at 77-degrees Fahrenheit ambient, pocket plate construction. Maximum battery discharge shall be automatically limited to the value recommended by Battery Manufacturer of nominal battery voltage, with full rated unit output during discharge.

2.06 BATTERY CHARGER

- A. General
1. Battery charger shall be solid state specifically designed for the type of batteries used in the system.

2. Battery charger shall have automatic protection against short circuits, low battery condition, DC-over voltage protection and protected against thermal runaway.
3. Charger shall automatically maintain correct battery charge conditions, with float charging and periodic equalize battery charges, within plus or minus 0.05 volts of Battery Manufacturer's recommendations.
4. The charger shall completely restore fully discharged batteries from the input line source, to full battery charge condition in less than 24 hours.

2.07 CABINET

- A. General
 1. The cabinetry shall contain all components, inverter, transformers, power supplies, battery charger, including the batteries, free standing with hinged locking door. All components shall be accessible from the front for maintenance and removal.
 2. Units requiring side access for cooling air or maintenance shall not be acceptable unless the Drawings specifically show the permitted side access space provisions.
 3. Provide water shields on cabinets, to protect the ELBU from fire sprinkler discharge water damage.
- B. Cabinet Construction
 1. The cabinets shall be metal, NEMA 1 enclosure, equipped with a key-operated access lock.
 2. Manufacturer's standard finish color with rust inhibitor "primer" and acid-resistant finish paint.
 3. Battery shelves shall permit the batteries to be tested or have battery fluids added with-out having to remove the batteries.
 4. The doors shall open full without affecting the operation of the unit. Conduit knockouts shall be provided on both sides, bottom and top of the cabinet for connection of line and load circuits. Provide dead front or insulated covers over exposed energized parts to prevent accidental contact when doors are open.
- C. Electrical Connections
 1. Provide line and load terminal lugs and identification tags on all circuits.
- D. Size
 1. Maximum cabinet size including batteries shall not exceed those shown on drawing, but in no case larger than as follows:
 - a. Up to 4600VA at 80% power factor rated load output: 43-inches wide by 84-inches high by 21-inches deep.
 - b. 4601VA to 11000VA at 80% power factor rated load output: 85-inches wide, by 84-inches high by 24-inches deep.
 - c. 11001VA to 17,500VA at 80% power factor rated load output: 128-inches wide by 84-inches high by 26-inches deep.

2.08 COMMUNICATION PORTS

- A. General
 1. The ELBU shall provide a standard RS-232 Bi-directional Serial communications port, for communicating with portable computers. Provide software with the ELBU for control, monitoring and diagnostic/maintenance

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operations of the ELBU. The software shall operate on Microsoft-Windows® based, PC style computers, using 3.5-inches "floppy-disk" magnetic storage media, or 5.25-inch "CD/DVD" ROM.

2. The PC computer is not included in the Contract Scope of Work.
- B. Remote Monitoring and Control
1. Facsimile/Modem Communications Panel: Shall automatically transmit system's operating status reports over a dedicated "dial-up" telephone line to remote locations. Provide 1-inch conduit with (ANSI/EIA/TIA-568B) two Category-6, 4-pair, UTP cables and homerun to IDF/MDF telephone terminal.
 2. Each designated location shall automatically receive a unit status reports transmission following all monthly and annual test cycles or when an alarm conditions is detected by the system's self-diagnostic electronics.
 3. Status reports shall be software programmable and include readings on key operating parameters as well as complete alarm and inverter log printouts.
 4. The ELBU Manufacturer shall provide 364 calendar days duration, remote monitoring, and supervision of each ELBU. The start date shall begin from the Construction Contract substantial completion date, notice of completion. Provide not less than two written status reports, to the District's Representative, at 180 calendar days and 330 calendar day milestones.
 5. The District and Manufacturer shall have the option to renew the Manufacturer's monitoring control Contract at a negotiated fair market price and terms, at the end of the initial 364 calendar day periods.
- C. Monitoring and Communications Circuits
1. Provide monitoring and communication circuits as follows:
 - a. One 0.75-inch conduit, homerun from each ELBU to nearest telephone/ data terminal backboard, with two EIA/TIA-568C Category-6A 4-pair UTP communication cables in conduit.
 - b. One 0.75-inch conduit, homerun from each ELBU to Building Automation System (BAS) communications transponder, with two EIA/TIA-568C Category-6A, 4-pair UTP communications cables in conduit.

PART 3 - EXECUTION

3.01 TESTING

- A. General
1. All units and batteries shall be inspected for damage as soon as they are received. Specifically check to see if wet cell batteries have been turned over in shipment and whether the equipment cabinets have received any severe dents which might cause internal damage. Remove and replace all damaged equipment with new undamaged equipment.
 2. Use only the factory provided knock-out areas and conduit entry provisions on the equipment for wiring. Care shall be taken not to let metal slugs or chips get into the equipment cabinet.
 3. Prior to energizing equipment, perform measurements on the incoming and load output AC lines to the equipment to insure that the proper voltage level is available and that there are no ground faults or high potentials between conductors or between phase conductor to neutral/ground.
 4. Prior to installing the fuses, or closing the circuit breaker in the battery circuit, verify correct battery voltage, polarity markings, battery electrolyte level and all electrical connections are secure.

5. Prior to turning the system on for any tests, the unit shall be bypassed with the mains connected to feed the load directly and the currents in each conductor measured and balanced. Follow Manufacturer's instructions for installation, connection, and energizing equipment.
 6. Batteries which are shipped with the electrolyte in the battery cells shall be maintained on a float charger when not installed and energized, operating the emergency power unit. Batteries shipped without electrolyte installed in the battery cells shall not have electrolyte added until equipment is installed and ready to be energized. Batteries which are not handled with this procedure will be rejected, shall not be used, and shall be replaced with new batteries at the Contractors expense.
 7. Provide Factory Authorized Field Service Technician factory start-up to inspect, energize, test, and certify the correct system installation, connections, and operation. Provide written acceptance field service report, six copies, to District's Representative.
- B. Commissioning (Additional Requirements)
1. Setup, testing, startup, and commissioning shall be performed by Factory Technician(s) trained, certified, and authorized by the Equipment Manufacturer. Final commissioning shall be performed after installation and connections are complete.
 2. Provide system programming and setup of all control sequences for the emergency/exit lighting control system.
 3. Simulate normal source power failure by opening (turn-off) building main service disconnect and verify connections and operation of each electrical system device connected to the system on both normal power source and emergency power sources. Simulated test time for operating duration connected on the emergency systems shall be not less than 90 continuous minutes without failure or anomalies in the system.
 4. Record and document electrical demand load and sequence of operations on the ELBU system with all connected loads operating, including but not limited to:
 - a. Fire alarms
 - b. Egress/exit lighting
 - c. Doors
 - d. auto-loading and overload shedding controls
 5. Test all control system functions after the installation and connections are complete and the system has been energized. Verify each control sequence of operation and each device to be controlled are each operating correctly.
 6. Record and document each device setup and program setting.
 7. Submit written report (six copies) to District's Representative certifying commissioning has been performed; all respective systems are operating correctly and document all software setup and each device setting.

3.02 SEISMIC EARTHQUAKE

- A. General
1. The entire unit shall be installed and anchored to building structure to comply with Seismic Earthquake Requirements.
 2. Install seismic restraints on all batteries.

3.03 FACTORY SERVICE AGREEMENT (FIRST YEAR OPERATION)

A. General

1. Provide site visits and written reports for each ELUB at unit start-up, commissioning, and again approximately 12 months after completion of testing and commissioning. Shall be included as part of the base Contract Scope.
2. Factory Authorized Technician shall test all ELUB options, accessories and functions, physical, electrical, and mechanical inspection. Simulate normal source power outage and recharge functions.
3. ELUB factory remote monitoring and reporting of each ELUB status, using telephone communications line provided by the District.
4. The base Contract initial first year operation service scope shall be renewable, if mutual agreement between the ELUB Manufacturer and the District is accomplished for service cost, scope and renew.
5. Provide three copies of factory service proposal renew agreement to the District's Representative.

**END OF SECTION 26 5213
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SECTION 26 5668

EXTERIOR ATHLETIC LIGHTING

PART 1 – GENERAL

1.01 SUMMARY

- A. Work covered by this Section of the Specifications shall conform to the Contract Documents, Engineering Plans as well as State and Local Codes.
- B. The purpose of these Specifications is to define the Lighting System Performance and Design Standards for Sherbeck Field using an LED Lighting source. The Manufacturer/Contractor shall supply lighting equipment to meet or exceed the Standards set forth in these Specifications.
- C. The Sports Lighting will be for the following venues:
 - 1. Fullerton College – Sherbeck Field
 - 2. Home and Visitor Egress Lighting
- D. The primary goals of this Sports Lighting Project are:
 - 1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore, light levels are guaranteed to not drop below specified target values for a period of 25 years.
 - 2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators, and neighbors. The LED design should provide better control than a good HID design.
 - 3. Life-cycle Cost: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.
 - 4. Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 25-year life cycle. All communication and monitoring costs for 25-year period shall be included in the bid.

1.02 LIGHTING PERFORMANCE

- A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed, and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance with IES RP-6-15, page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Football	50 footcandles	2.0:1	72	30' x 30'
Home/Visitor Egress	8 footcandles	N/A	Home / Visitor	10' x 10'

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- B. Hours of usage: Designs shall be based on the following hours of usage

Area of Lighting	Annual Usage Hours	25-year Usage Hours
Stadium	300	7,500

- C. Color: The lighting system shall have a minimum color temperature of 5700K and a CRI of 70.

- D. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on Photometric Report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

# of Poles	Pole Designation	Pole Height
2	F1 – F2	100-foot
2	F3 – F4	120-foot
2	F1 – F2	60-foot

1.03 ENVIRONMENTAL LIGHT CONTROL

- A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers, and external shields. No symmetrical beam patterns are accepted.

- B. Spill Light and Glare Control: To minimize impact on adjacent properties, spill light and candela values must not exceed the following.

	Average	Maximum
East Property Line Maximum Vertical Footcandles	0.0 fc	0.0 fc
East Property Line Horizontal Footcandles	0.0 fc	0.0 fc

- C. Spill Scans: Spill scans must be submitted indicating the amount of horizontal and vertical footcandles along the specified lines. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights. Illumination level shall be measured in accordance with the IESNA LM-5-04 after 1 hour warm up.
- D. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified independent Testing Laboratory with a minimum of 5-years' experience or by a Manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

1.04 LIFE-CYCLE COSTS

- A. Manufacturer shall submit a 25-year life cycle cost calculation as outlined in the required submittal information.
- B. Preventative and Spot Maintenance: Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 25 years from the date of equipment shipment. Individual outages shall be repaired when the usage of any field is

materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

PART 2 – PRODUCT

2.01 SPORTS LIGHTING SYSTEM CONSTRUCTION

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired, and tested.
- B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
- C. System Description: Lighting system shall consist of the following:
 - 1. Galvanized steel poles and cross-arm assembly.
 - 2. Non-approved pole technology:
 - a. Square static cast concrete poles will not be accepted.
 - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long-term performance concerns.
 - 3. Lighting systems shall use concrete foundations. See Section 2.3 for details.
 - a. For a foundation using a pre-stressed concrete base embedded in concrete backfill the concrete shall be air-entrained and have minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection; actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.
 - b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or re-enforced pier design pole erection may occur after 7 days. Or after a concrete sample from the same batch achieves a certain strength.
 - 4. Manufacturer will supply all drivers and supporting electrical equipment
 - a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure.
 - b. Alternate: Integral drivers mounted at the top of the pole will require a pole mounted enclosure approximately 10 feet above grade. The enclosure shall include a disconnect per circuit and surge protection.

5. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.
6. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
7. All luminaires, visors, and cross-arm assemblies shall withstand 150 mph winds and maintain luminaire aiming alignment. Luminaire shall be painted black.
8. Control cabinet to provide remote on-off control and monitoring of the lighting system. See Section 2.4 for further details.
9. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.
 - a. Integrated grounding via concrete encased electrode grounding system.
 - b. If grounding is not integrated into the structure, the Manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2AWG for poles with 75 feet mounting height or less, and 2/0AWG for poles with more than 75 feet mounting height.

B. Safety: All system components shall be UL listed for the appropriate application.

2.02 ELECTRICAL

- A. Electric Power Requirements for the Sports Lighting Equipment:
 1. Electric power: 480-volt, 3-phase
 2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed 3% of the rated voltage.
- B. Energy Consumption: The kW consumption for the field lighting system shall be 76.02kW.

2.03 STRUCTURAL PARAMETERS

- A. Wind Loads: Wind loads shall be based on the 2016 California Building Code. Wind loads to be calculated using ASCE 7-16, a design wind speed of 110 MPH, exposure Category C and wind importance factor of 1.0.
- B. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2009 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-5).
- C. Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. Converse Consultants, Report No.# 17-31-252-01, dated October 9, 2017.
- D. Foundation Drawings: Project specific Foundation Drawings stamped by a registered Engineer in the State where the project is located are required. The Foundation Drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole. These Drawings must be submitted at time of bid to allow for accurate pricing.

DSA Information Overview

DSA Inspection: The California Building Code, Title 24 Requirements, state that a DSA approved Inspector be present to inspect pre-cast concrete bases and shop welding during production. DSA also requires that the concrete bases be inspected/ tested by an approved laboratory. Musco is providing this for informational purposes only and is not involved in the actual contracting of the Inspectors or laboratories by the customer. Musco will, however, assist in coordinating the activities required to meet DSA Requirements.

The DSA website can provide you with a list of approved labs. You may utilize any DSA-approved testing lab and Musco will assist in coordinating the individual inspections of bases and welds. The first inspection would be at Fonterra Concrete Products Inc. in Elk River, MN to inspect the pouring of the concrete base. After the bases have been poured, there is a 28-day cure time and a successful pour test before they can be shipped to Musco where they will join the remainder of your product and be scheduled for delivery to the job site (if your project is on a tight time frame, there are pre-inspected DSA approved concrete bases that are presently in Musco's inventory. These bases will have already passed the 28-day cure time and the inspection house will have the approved lab results for these bases. Musco can provide you with the company name and contact information upon request). Otherwise during this cure time, the inspection lab will work with Musco to schedule a time for inspection of welds on the poles at Musco Lighting, LLC. Seam Weld Inspections (if required) is coordinated through Musco and Valmont at Valley Nebraska a Musco Vendor.

2.04 CONTROL

- A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.
- B. Lighting contactor cabinet(s) constructed of NEMA Type 4 aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.
- C. Dimming: System shall provide for "High, Medium, Low".
- D. Remote Lighting Control System: System shall allow Owner and Users with a security code to schedule on/off system operation via a web site, phone, fax or email up to 10-years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained Staff shall be available 24/7 to provide scheduling support and assist with reporting needs. The Owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute "early off" commands by phone. Scheduling tool shall be capable of setting curfew limits. Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.
- E. Remote Monitoring System: System shall monitor lighting performance and notify Manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).

- F. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices. Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the Owner.
 - 1. Cumulative hours: shall be tracked to show the total hours used by the facility.
 - 2. Report hours saved by using early off and push buttons by users.
- G. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 25 years.
- H. Entertainment Features: Control System shall store six preprogrammed light shows per field with option for customized scenes. Shows shall be initiated by a Manufacturer provided touchscreen user interface on the control system network.

PART 3 – EXECUTION

3.01 SOIL QUALITY CONTROL

It shall be the Contractor's responsibility to notify the Owner if soil conditions exist other than those on which the foundation design is

3.02 DELIVERY TIMING

- A. Delivery to the job site for DSA projects can vary from 6-14 weeks. Musco must have the following information in order to schedule production of a project:
 - 1. Approved Submittals
 - 2. Stamped/signed approved DSA Drawings,
 - 3. Contact information for the DSA certified inspection lab and specific Inspection Requirements
 - 4. Confirmation of order details including voltage/phase and pole locations. (Due to the built-in custom light control per luminaire, pole locations need to be confirmed prior to production. Changes to pole locations after the product is sent to production could result in additional charges).

3.03 FIELD QUALITY CONTROL

- A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- B. Field Light Level Accountability
 - 1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 Years.
 - 2. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the Requirements of the Performance Specifications and submitted information, the Manufacturer shall be required to make adjustments to meet Specifications and Satisfy Owner.

3.04 WARRANTY AND GUARANTEE

- A. 25-Year Warranty: Each Manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other Manufacturers.
- B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

PART 4 - DESIGN APPROVAL

4.01 PRE-BID SUBMITTAL REQUIREMENTS (NON-MUSCO)

- A. Design Approval: The Owner / Engineer will review pre-bid submittals per Section 4.0.B from all the Manufacturers to ensure compliance to the Specification 10 days prior to bid. If the design meets the Design Requirements of the Specifications, a letter and/or Addendum will be issued to the Manufacturer indicating approval for the specific design submitted.
- B. Approved Product: Musco's Light-Structure System™ with TLC for LED™ is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this Section at least 10 days prior to bid. Special manufacturing to meet the Standards of this Specification may be required. An Addendum will be issued prior to bid listing any other approved Lighting Manufacturers and designs.
- C. All listed Manufacturers not pre-approved shall submit the information at the end of this Section at least 10 days prior to bid. An Addendum will be issued prior to bid; listing approved Lighting Manufacturers and the design method to be used.
- D. Bidders are required to bid only products that have been approved by this Specification or Addendum by the Owner or Owner's Representative. Bids received that do not utilize an approved system/design, will be rejected.

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**REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS
(NOT PRE-APPROVED) 10 DAYS PRIOR TO BID**

All items listed below are mandatory, shall comply with the Specification and be submitted according to Pre-Bid Submittal Requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. Submit checklist below with submittal.

Yes /No	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the Manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	Equipment Layout	Drawing(s) showing field layouts with pole locations
	C	On Field Lighting Design	Lighting Design Drawing(s) showing: a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaires, total kilowatts, average tilt factor; light loss factor.
	D	Off Field Lighting Design	Lighting Design Drawing showing initial spill light levels along the boundary line (defined on bid Drawings) in footcandles. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights.
	E	Environmental Light Control Design	Environmental glare impact scans must be submitted showing the maximum candela from the field edge on a map of the surrounding area until 500 candelas or less is achieved.
	F	Photometric Report	Provide first page of photometric report for all luminaire types being proposed showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years' experience.
	G	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the Performance Requirements noted in these Specifications at no expense to the Owner. Light levels must be guaranteed to not fall below target levels for warranty period.
	H	Structural Calculations	Pole structural calculations and foundation design showing Foundation Shape, Depth Backfill Requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the Foundation Drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the State of California, if required by Owner.
	I	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system to include monitoring. They will also provide ten references of customers currently using proposed system in the State of California.
	J	Electrical Distribution Plans	Manufacturer bidding an alternate product must include a revised Electrical Distribution Plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the State of California.
	K	Warranty	Provide written warranty information including all terms and conditions. Provide ten references of customers currently under specified warranty in the State of California.
	L	Project References	Manufacturer to provide a list of five projects where the technology and specific fixture proposed for this project has been installed in the state of California. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number.
	M	Product Information	Complete bill of material and current brochures/cut sheets for all product being provided.

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N	Delivery	Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information.
O	Non-Compliance	Manufacturer shall list all items that do not comply with the Specifications. If in full compliance, tab may be omitted.
P	Life-cycle Cost Calculation	Document life-cycle cost calculations as defined in the Specification. Identify energy costs for operating the luminaires. Maintenance cost for the system must be included in the warranty. All costs should be based on 25 Years. (complete table below)

25-Year Life Cycle Operating Cost			
a.	Luminaire energy consumption _____ luminaires x _____ kW demand per luminaire x _____ kWh rate x <u>300</u> annual usage hours x 25 years		
	TOTAL 25 -Year Life-cycle Operating Cost	=	

The information supplied herein shall be used for the purpose of complying with the Specifications for Sherbeck Field. By signing below I agree that All Requirements of the Specifications have been met and that the Manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting Specifications and not listed in the Non-Compliance Section.

Manufacturer: _____ Signature: _____

Contact Name: _____ Date: ____/____/____

Contractor: _____ Signature: _____

**END OF SECTION 26 5668
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SECTION 27 2000

ELECTRONIC NETWORK SYSTEMS INFRASTRUCTURE

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26, 27 and 28.
 - 2. General Provisions and Requirements for electrical work.
- B. Provide Electronic Network Systems Infrastructure for the following systems:
 - 1. Computer Data Networks.
 - 2. Telephone and Voice Communications.
 - 3. Fire Alarm Network.
 - 4. Other special systems described in the Contract Documents.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Drawings Submittals
 - 1. Drawings shall be submitted on reproducible sepias and AutoCAD® Version 2.2 (or later revision) data files on CD/DVD-ROM disk, WINDOWS®-XP or Version-7 or Version-10 format.
 - 2. Submit redrawn Building Floor Plan for each building area, same scale as the Contract Drawing.
 - 3. Plans shall show walls, doors, windows, furniture, infrastructure, outlets, and network systems equipment locations. Show point-to-point interconnecting cables, pathways, conduit, conduit sizes, circuit types, along with circuit identification names, numbers, and quantities between all components.
 - 4. Provide scaled Elevation Drawings of each equipment rack, terminal blocks, terminal backboard, and terminal room/closet showing location and arrangement of each equipment component, outlet, and cable training provisions, with estimated weight of each complete assembly.
 - 5. Submit block wiring diagrams showing major system components, outlets, equipment racks, terminal blocks, signal loss with interconnecting circuit conductors, splices, port-able patch cords and connectors. Riser type diagram shall be provided if the building has more than one floor level, with information shown on riser diagram corresponding for each respective floor.
- B. Submit Manufacturer's standard catalog data for each component. The submittal shall be arranged in the order of the Specification and shall list the Specification paragraph number, the name, the proposed model and Manufacturer for each item as well as a reference indicating the specific piece of data which can be easily located in the brochure. The Manufacturer's data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of items. The data sheet shall completely describe the proposed item. Where modification to the equipment is necessary to meet the operational Requirements of the Contract Documents, the brochure shall include complete Mechanical and

Electrical Shop Drawings, detailing the modification. The brochure shall include a listing of the Outlet Rough-In Requirements for every device and equipment item. The applicable symbol which illustrates that rough-in item on the job plans shall be drawn on the proposal, opposite the description of the rough-in to facilitate locating the data by Field Personnel. Submit elevation and dimensional information.

- C. Performance Calculation:
 - 1. Provide engineered calculations showing the Passive Cable System Signal Attenuation losses of the proposed installed system. The intent is not to require calculations for every system segment, port, and outlet. The intent is to require engineered calculations for proposed typical worst-case port to port, head end to farthest distance outlet and patch port to outlet signal attenuations.
 - 2. Provide calculations for a minimum of 50 complete channel/circuit paths. The calculations shall include attenuation insertion losses for each system component including individually itemized cable-fiber/wire; outlet, termination, connector, electronic component (if any), coupler and patch cord along the entire path from the head end equipment to the end use outlet.
 - 3. The calculations shall serve as the basis for verifying the system performance with the system testing specified in the Contract Documents.
- D. Provide proposed nameplate and outlet identification/color coding system. Indicate proposed identification naming sequence and methods, itemized for review.
- E. Submit Manufacturer Certified Test Reports showing test documentation for the proposed material that the material meets or exceeds the performance standards defined in the Contract Documents. The testing and results shall reflect worst case performance based on a minimum of ten samples. Tests shall be certified by a Nationally Recognized Independent Test Lab (i.e., ETL, UL, etc.). The Manufacturer shall certify in writing the material has been manufactured and tested to comply with the Requirements defined in the Contract Documents.
- F. Submit three samples of each of the following, fully assembled with 24-inches of cable type connected:
 - 1. Copper wire outlet and connector, with each type of specified inserts.
 - 2. Copper cables and patch cords, each type.
 - 3. Fiber optic cables and patch cord each type.
 - 4. Mechanical splice - fiber optic.
 - 5. Fusion splice - fiber optic.
 - 6. Fiber optic outlet and connector each type.
 - 7. Fiber optic cable connector each type of termination, with interconnection coupler.
 - 8. Patch panel each type.
 - 9. Coverplate each type.

1.03 APPLICABLE STANDARDS

- A. Individual component Production/Manufacturer Testing and Labeling.
 - 1. The equipment shall be UL listed, labeled, and approved for the application shown in the Contract Documents.
 - 2. ETL (USA) each network systems infrastructure component. Third party testing, documentation, and certification for performance compliance of each component with the UL, ANSI, TIA, and EIA Applicable Standards specified in the Contract Documents.

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- B. The complete system material, equipment, testing, installation, workmanship, and installed performance shall comply with the Mandatory Requirements and the Guideline/Recommendation Requirements of the following latest published version, supplements, latest revision including Addendums and TSB. Both the mandatory and advisory criteria shall be included as Requirements of the Contract Documents:
1. TIA-526 Optical Power and loss measurements – multimode and single mode fiber.
 2. ANSI/TIA/EIA-568C Commercial Building Telecommunications Standards.
 3. ANSI/TIA/EIA-569B – Commercial Building Standards for Telecommunications Pathways.
 4. ANSI/TIA/EIA-570A Residential Telecommunications Standard.
 5. ANSI/TIA/EIA-598B Optical Fiber Cabling Color-Coding.
 6. ANSI/TIA/EIA-606A Administrative Standard for Commercial Telecommunications Infrastructure.
 7. ANSI/TIA/EIA-607 Commercial Buildings Grounding and Bonding Requirements for Telecommunications.
 8. FCC – FYU/FT6.
 9. ISO/IEC 11801
 10. National Electrical Code (NEC) and California Electrical Code (CEC) including Articles 770 and 800 with ETL verified testing and Local Code Jurisdictions.
 11. NECA/NEIS, National Electrical Contractors Association, National Electrical Installation Standards:
 - a. 301 – Standard for Installation and Testing for Fiber Optic.
 - b. 568-Standard for Installing Building Telecommunications Bonding and Grounding.
 - c. 607-Telecommunications
 12. Manufacturer's recommendations for the respective equipment.
- C. Network Performance
1. The entire completed Electronic Network Systems Infrastructure shall be tested and provide electronic data/network and telephone/voice multi-channel communications latest Revisions, Standards and Addendums for the following protocols:
 - a. IEEE 802.3/ETHERNET latest revisions.
 2. Twisted pairs copper wire (100-meter path length unless indicated otherwise)
 - a. 10Mbps 10Base-T, 100Mbps 100Base-Tx.
 - b. 1000Mbps (1Gbps) 1000 Base-Tx.
 - c. 10,000 Mbps (10Gbps) 10Gb Base-Tx.
 - d. IEEE-802.3 for Power Over Ethernet (POE) and Power Over Ethernet-Plus (POE Plus).
 3. Fiber optic, 550-meter communications pathway distance, OM4 standard multimode and OS2 single-mode.
 - a. 10Mbps 10Base-F1, 100Mbps 100Base-FX,
 - b. 1000Mbps 1000Base-Lx-Sx
 - c. 10,000 Mbps (10Gbps) for fiber optics
 - d. Single Mode path length performance increase Requirement to 3000 meters.
 4. IEEE 802.5/TOKEN RING.
 5. APPLETALK (Phone-net).
 6. FDDI - Distributed data interface on fiber or copper wire, 100Mbps.
 7. 100VG – Any LAN
 8. TIA/EIA serial and Bi-directional RS-232 and RS-485, including Star-Hub repeaters.

9. ANSI - TPPMD 55Mbps, 155Mbps and 622Mbps Asynchronous Transfer Mode - ATM.
- D. The Complete Telephone/Voice Infrastructure System shall be suitable for the telephone/voice analog and digital communications and VoIP protocols. The system shall be compatible with the telephone/voice equipment installed as part of the Contract.
- E. Installation of All Infrastructure Equipment, Devices, Splices, Terminations, Cables, Outlets, etc. shall comply with Manufacturer's recommendations.

1.04 EQUIPMENT QUALIFICATIONS

- A. Equipment
 1. The Supplier of the equipment shall be the Factory Authorized Distributor and service facility for the brands of equipment and material provided.
 2. Network systems infrastructure equipment and materials shall all be the product of one of the individual same Manufacturers as follows. Typical unless specifically described otherwise:
Fiber – Sumitomo FutureFLEX® Air Blown Fiber Cabling System.
Copper – CommScope Systimax per College IT Standards with 25-year Manufacturer's Warranty.
- B. Installation Certification
 1. Work and material for cables, cable terminations, outlets and related components for infrastructure systems shall be performed by Certified Installers. The Installer shall be certified by the respective Product Manufacturers.
 2. The Manufacturers of the indicated work and material shall provide an Installer education/training and certification program for the supplied products.
 3. The Installers performing the Contract Work for the indicated products shall have attended and successfully completed each of the respective Manufacturer's installation training education programs for the specified products.
 4. Submit six copies of the Manufacturer's Certifications for each installer performing the work. The submittal shall be approved by the Owner's Representative prior to initiating any related Contract Work.
 5. Contract material installed, and work performed by Installers not complying with these Requirements shall be removed. Removal of work and material not in compliance with these Requirements shall be done at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions. New material and work required to replace the non-complying removed work and material shall be provided at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions.
- C. Extended Material and Performance Warranties
 1. In addition to the warranty Requirements described elsewhere in the Contract Documents, provide the following extended material and performance warranties. The warranty period shall be for not less than 15-years from the Contract Notice of Completion.
 2. Warranty scope includes materials and performance for network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors.

3. Repair or replace the defective material with new material at the Project premise, to comply with the performance standards outlined in the Contract Documents during the warranty period.
4. Submit seven copies of proposed warranty statements, with Shop Drawing submittals.

1.05 ABBREVIATIONS

<u>Abbreviation</u>	<u>Terminology</u>
ACR	Attenuation to Cross Talk.
AHJ	Authority Having Jurisdiction.
Backbone.....	Circuit interconnections between MDF and IDF patch panel locations.
dB	Decibel.
dBm	Decibel referenced to a milliwatt.
Demarc	Demarcation location where operational control change occurs, or ownership change occurs.
ft.....	Feet.
GHz.....	Gigahertz.
Gbps	Gigabits per second.
Horizontal Connection, and/or Horizontal wiring	Circuit interconnections between individual workstation outlet location to respective IDF or MDF equipment rack patch panel.
IDF	Intermediate Distribution Frame (horizontal or vertical cross connect) for an individual building area/floor.
km	Kilometer-lkm.
kPSI	1000 pounds per square inch.
m.....	Meter = 39.37 inches.
Mbps	Megabits per second.
MDF	Main Distribution Frame (central/main cross connect) for multi-building site or for a single individual building.
MHz	Megahertz.
MIC	Micrometer
mm.....	Millimeter = 10^{-3} meter.
NEXT	Near end cross talk.
nm	Nanometer = 10^{-9} meter.
pF.....	Picofarad = 10^{-12} farad.
Provide.....	Furnish, install, and connect.
RTDE	Equipment rack mount fiber optic termination distribution enclosure, with fiber optic patch panel.
RMSE	Equipment rack mount fiber optic enclosure, splice only (without patch panel).
STP.....	Shielded individual twisted pairs copper wire.
ScTP	Shield Screened Twisted Pairs copper wire.
Trunking-Cable	Individually insulated twisted pair copper wire cable, consisting of 24-pair or more of conductors inside a common cable jacket. Terminate and connect to common terminal-block location at each end of the trunking-cable.
um.....	Micrometer = 10^{-6} meter.

USE	Universal Splice Enclosure.
UTP	Unshielded twisted pairs copper wire.
VoIP	Voice communications over Internet Protocol.
WGNA.....	Wide Band Gigabit Networking Alliance.
Workstation or.....	Spaces remote from the MDF/IDF terminal
Workstation location	room/closet, where user equipment interacts and connects with the electronic systems infrastructure equipment connection outlet device.
WMIC.....	Wall Mount fiber optic cable Interface Cabinet.

1.06 MATERIALS AND METHODS

- A. Material and Labor not complying with the Contract Documents shall be removed by the Contractor from the Project Site. Material and labor complying with the Contract Documents shall be provided.
- B. All the cost to remove deficient work and material, provide work and material complying with the Contract Documents and the direct, indirect, incidental damages and Contract delays resulting from complying with these Requirements shall be the sole responsibility of the Contractor and shall be included in the bid price.
- C. System Performance Requirements
 1. The work, performance and type of materials provided as part of the Contract shall comply with the following ANSI/TIA/EIA-568C and related Standards for all Electronics Network Systems Infrastructure work and materials described in the Specifications and shown the Drawings:
 - a. Fiber – Sumitomo Electric FutureFLEX Air Blown Fiber Cabling system.
 - b. Voice/Data/WLAN Network systems: Category-6A (blue)
 - c. Trunking-cable: Building to Building – PE-89, 24-gauge, copper transition cable – ARMM 24-gauge.
 2. The Electronic Network Systems Infrastructure system shall be based on “star-topology”; for MDF to IDF backbone connections and workstation outlet to MDF / IDF horizontal connections.

PART 2 - PRODUCTS

2.01 AIR BLOWN FIBER CABLES

- A. General
 1. The Contractor shall install cables and equipment that carry a Manufacturer’s Warranty. The various Sections of this Specification pertain to specific Products and/or Installation Requirements that must conform to the Warranty Requirements of the Cabling System Manufacturer. The District is utilizing Sumitomo FutureFLEX® Air Blown Fiber Cabling system throughout the campus.
 2. Cables shall qualify as 100% recyclable materials disposal, RoHS Regulation complaint.
 3. All fibers in a multi-fiber cable shall be fully operational within the performance characteristics specified prior to and after the cable is installed. The use of spare fibers in the cable to compensate for defective fibers is not permitted. Defective cables shall be removed and replaced with fully functional cables at no additional cost to the Contract.

4. Cables shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with Specified Requirements. ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
 5. Each fiber shall be individually identified with factory color-coding or factory imprinted label. The outer cable jacket shall be imprinted with date, Manufacturer's model, and catalog number, along with Agency listing identification.
 6. Fiber optic cable shall be a product of the same Manufacturer, including portable patch cables.
 7. Cables installed in raceways or conduits below grade, through in-grade man-holes or pullboxes shall be rated for installation in water/wet locations.
 8. Provide overall outer jacket enclosing all fibers inside jacket. Cables containing less than seven fiber strands shall be provided with a color-coded outer jacket (red or orange).
 9. Single mode:
 - a. Fiber optic cables optical fibers, (8.3/125) single mode optical glass fibers, 8.3-micron core fiber and 125-micron fiber cladding, 0.11 numerical aperture. Optical fibers shall be 100-kPSI proof tested, with maximum 0.7-micron flaw size. For operation at 1310nm and 1550nm wave lengths.
 - b. Maximum attenuation:

@ 1310nm- wavelength	0.5dB @ 1km length
@ 1550nm- wavelength	0.4dB @ 1km length
 - c. Maximum dispersion:

@ 1310nm- wavelength	2.8ps/nm km length
@ 1550nm- wavelength	18.0ps/nm km length
 - d. Manufacturer: Sumitomo FutureFLEX® Air Blown Fiber cabling system
 10. Multimode (50/125)
 - a. 50/125 fiber optic cables optical fibers, graded index multimode optical glass fibers, 50.0-micron fiber core and 125-micron fiber cladding, 0.2 numerical apertures. Optical fibers shall be 100 kPSI proof tested, with maximum 0.7-micron flaw size for dual operation at 850nm and 1300nm wave lengths.
 - b. Minimum bandwidth:

@ 850nm-wavelength	3500Mhz per km length
@ 1300nm-wavelength	500Mhz per km length
 - c. Maximum attenuation:

@ 850nm-wavelength	3.0db @ 1km length
@ 1300nm-wavelength	1.0db @ 1km length
 - d. Laser-optimized "OM4" optical multi-mode standards.
- B. Loose Tube Gel-filled Cables
1. Multiple, loose tube buffer tubes, gel filled. Each buffer tube shall contain the same quantity of optical fibers, but not more than twelve optical fibers in each buffer tube.
 2. Buffer tubes shall be cabled around a central dielectric strength member. The central strength member shall be centered along the length of the cable.
 3. Aramid yarn, non-optical, strength fibers shall extend continuously along the length of the cable.
 4. The cable interstitial spaces shall be flooded to inhibit water migration, with non-flammable water blocking gel.
 5. Each optical fiber shall be individually UV cured acrylate coated, 250-micron diameter coating over fiber cladding.

6. A seamless black polyethylene outer layer jacket shall envelope the entire cable.
 7. The cable shall be fungus resistant, UV resistant, and moisture resistant for installation indoors with or without an enclosed raceway and outdoors in underground enclosed raceway/conduit and manholes/pullboxes continuously flooded with water.
- C. Indoor/Outdoor Cables
1. The cable shall be fungus resistant, UV resistant, moisture resistant for installation indoors with or without an enclosed raceway and outdoors in underground enclosed raceway/conduit and manholes/pullboxes continuously flooded with water, and in conduits exposed to the sun.
 2. Each optical fiber shall be primary coated with 500-micron uniform acrylate tight buffered and with elastomeric uniform 900-micron diameter tight buffered, secondary coating. Aramid yarn strength member elements shall be tensioned and symmetrically and uniformly distributed around the fibers, along the length of the cable.
 3. An overall cable jacket uniformly extruded directly around and mechanically interlocked with the optical fibers/strength members. The extruded jacket shall form internal helical cusped ridges that interlock with the optical fibers and strength members. The inter-locking jacket shall not allow cable fibers to move axially within the cable jacket.
 4. Cables containing more than 24-optical fibers shall be constructed with sub-cable fiber bundles. Each sub-cable bundle shall contain equal quantities of optical fibers, with a separate PVC jacket around each sub-cable. Sub-cable and sub-cable jacket construction shall match the Overall Cable Requirements and Jacket Requirements.
 5. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents. ETL tested and certified to comply with or exceed Specified Requirements.
 - a. NEC – OFNR (Vertical Riser Type Locations) OFNP (UL FHC-25/50 LC Plenum Type Locations and locations where not continuously enclosed inside conduits for entire cable length).
 - b. NEC – OFNG (Where continuously enclosed inside conduits for entire cable length).
- D. Tight Buffered Cables
1. Each optical fiber shall be coated, 900-micron diameter uniform coating, with uniform tight buffering over the coating, uniform dielectric strength member surrounding the buffering coating and an overall jacket around each optical fiber assembly.
 2. Individual multiple optical fiber assemblies shall be symmetrically arranged around a central dielectric strength member. The central strength member shall be centered along the length of the cable.
 3. A dielectric strength member shall surround the fiber assemblies.
 4. An outer dielectric jacket shall envelope the entire cable.
 5. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents. ETL tested and certified to comply with or exceed Specified Requirements.
 - a. NEC - OFNP (UL FHC-25/50 LC Plenum type locations and locations where not continuously enclosed inside conduits for entire cable length).

2.02 TUBE CABLE - OUTSIDE PLANT

- A. Materials
 - 1. All tube cable sheath openings that are created for connecting tube cable cells in underground manholes or pull boxes shall be encased in an outside plant splice case designed for copper cables.
 - 2. The waterproof splice enclosure must be approved by the manufacturer for connecting tube cables.
 - 3. All tube cables shall be properly secured to the backboards, equipment racks, or ladder racks.
 - 4. Tube cable sizes shall be 19-, 7-, 4- or 2-cell depending on the design on the Drawings. The standard tube in conduit shall be Sumitomo TOX. For aerial use Sumitomo MSO.
- B. Manufacturer: Sumitomo Electric FutureFLEX® fiber tube cables.

2.03 TUBE CABLE DISTRIBUTION UNITS (TDU) - OUTSIDE PLANT

- A. Materials
 - 1. All tube cable sheath openings that are created for connecting tube cable cells in underground manholes or pull boxes shall be encased in an outside plant splice case designed for copper cables.
 - 2. The water-proof splice enclosure must be approved by the Manufacturer for connecting tube cables.
 - 3. All tube cables shall be properly secured to the backboards, equipment racks, or ladder racks.
 - 4. Tube cable sizes shall be 19-, 7-, 4- or 2-cell depending on the design on the Drawings. The standard tube in conduit shall be Sumitomo TOX. For aerial use Sumitomo MSO.
- B. Manufacturer: Sumitomo Electric FutureFLEX® Fiber Tube Cables.

2.04 FIBER OPTIC FIBER SPLICES

- A. General
 - 1. Fiber optic cable splices shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with/or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
 - 2. Fiber optic splices shall be the product of the same Manufacturer.
- B. Fusion Splicing
 - 1. Fusion splicing shall be performed with equipment providing the following features:
 - a. Cleaving and cleaning optical fiber.
 - b. Integral splice optimization verification system with local injection and detection.
 - c. Projection screen optics and fiber core alignment system.
 - d. Fiber cleaning/stripping.
 - e. Cleaning fiber ends and fusing of fiber together with an electric arc.
 - 2. Fusion splice insertion loss as measured at the completion of the splice shall be less than 0.1dB at specified cable wave lengths.

2.05 FIBER OPTIC FIBER CONNECTORS AND INTERCONNECTION COUPLERS

A. General

1. The connectors and interconnection couplers shall be compatible, maintain the same Performance Category rating and be compatible with the corresponding fiber optic cable type attached to the connectors.
2. Fiber optic cable connectors and interconnection couplers shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. Connectors and couplers shall comply with ANSI/TIA/EIA-568C, related Standards, Amendments, TSB, and TIA/EIA-Fiber Optic Connector Intermateability Standard (FOCIS) documentation.
3. Fiber optic connectors and couplers shall be the product of the same Manufacturer.
4. Shall be UL listed and comply with UL94V-0.
5. Color code connectors for fiber optic cables to match the respective fiber optic strand/jacket color.

2.06 COPPER WIRE CABLES (TWISTED PAIRS)

A. General

1. Conductors shall be copper wire, individually insulated and color coded, with multiple conductors arranged in twisted pairs.
2. An overall non-conductive jacket shall encase the copper wires and any shielding (where shielding is specified) shall also be encased by the jacket.
3. Cables shall be UL listed, complying with NEC National Electrical Code, National Fire Protection Agency and NFPA Requirements for each installation location shown. ETL tested and certified to comply with or exceed Specified Requirements.
 - a. NEC – MPP/CMP, FHC-25/50 (Plenum type locations and locations where not continuously enclosed inside conduit).
 - b. NEC – MPR/CMR (Vertical riser type locations).
 - c. ANSI/TIA/EIA-568C; including related standards, amendments, and TSB.
4. Electronic network systems infrastructure cables that are not installed inside conduit raceways. Electronic network systems infrastructure cables that are installed in concealed spaces including plenums and non-plenums; access floors, ceiling spaces, walls, floor, etc., and/or installed without continuous raceways. The cable insulation and jacket shall be listed and labeled “limited combustible cable” (LC or LCC) and shall comply with the latest published revision of all of the following Additional Requirements.
 - a. Limited combustible “FHC-25/50” per UL-2424.
 - b. NEC/CEC;CMP, additional listing/labeling where the install location is an environmental air plenum, copper wire “FHC-25/50-CMP”.
 - c. NFPA-90A; ceiling cavity plenums, wall cavity spaces and raised floor cavity plenums, limited-combustible.
 - d. NFPA-5000; defines combustible material including wire and cable.
 - e. NFPA-75 computer rooms and electronic equipment room.
 - f. NFPA-13; spaces containing “limited combustible loading”.
5. Cables shall qualify as 100% recyclable materials disposal, RoHS Regulations complaint.
6. Cables installed in air plenums, air-handling spaces and cables installed without raceway or conduit shall also be UL listed and labeled for installation in air plenums.

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7. Cables installed in raceways or in conduits below grade, or through in-grade manholes and pullboxes, shall be rated for installation in water/wet locations.
 8. The outer cable jacket shall be imprinted with date, Manufacturer's model and catalog number and Agency (AHJ) listing identification.
 9. Copper wire Electronic Network Systems Infrastructure cable shall be a product of the same Manufacturer, including portable patch cables.
 10. The outer jacket of cables with less than nine pair of conductors shall be color-coded. The jacket color shall be different for each system type; multimedia; telephone/voice; computer/data network; and fiber cable jackets.
 11. 300-volt RMS insulation material for each data conductor shall be the same material; shall be the same electrical characteristics and shall be the same dielectric constant, for all data conductors contained within the respective common cable jacket, along the entire installed length of the cable. Data cables employing differing insulation materials for individual data conductors contained within a common cable jacket are not acceptable and shall not be provided.
 12. Propagation and "Skew" Rate
 - a. Skew rate (nominal velocity of propagation delay) between any twisted pair in a combination of four twisted pair conductors grouped in the same cable, shall not exceed 35-nano seconds between any wire pair contained in the conductor group, and as required by the cable Category rating, over a cable length of 328-feet (100 meters), for all frequencies up to the cable maximum frequency rating.
 - b. Nominal velocity of propagation, exceeding 70% of the speed of light.
 13. Large capacity feeder cables and trunking-cables
 - a. Copper wire cables with more than 24-twisted pairs of conductors shall be constructed with 25-pair binder groups of conductors. The cable binder groups shall be enclosed in colored binders and assembled to form a single cable. The twisted pair/binder groups shall be enclosed with multi-layer dielectric protective sheaths underneath a cable jacket enclosing the entire cable assembly. A corrugated metal 100% shield shall be provided under the cable jacket enclosing all conductors.
 - b. Cables shall be wet location rated and listed for installation in conduit, where the conduit is in a wet environment and/or high-temperature environment, including:
 - 1) Underground conduit.
 - 2) Inside manholes and pull boxes.
 - 3) Outdoor conduit exposed to weather and/or sunlight.
 - c. ANSI/TIA/EIA Category rating of cable assembly shall be Category-5E, trunking-cable.
- B. Category-6A Computer/Data Enhanced Cables – Voice/Data**
1. Category-6A cables shall be tested and shall pass ANSI/TIA/EIA test recommendations for Category-6A.
 2. Operational characteristics:

a. Wire size	24AWG solid copper (24AWG stranded copper for portable patch cables)
b. Quantity of twisted pairs	As indicated but in no case less than 4 twisted pairs
c. Impedance	100 OHM \pm 15%, 3-100MHz
d. Maximum Signal attenuation per 300 feet (100 meters)	6.3dB @ 1MHz 13dB @ 4MHz 18dB @ 8MHz

- 20dB @ 10MHz
- 25dB @ 16MHz
- 28dB @ 20MHz
- 32dB @ 25MHz
- 36dB @ 31.25MHz
- 52dB @ 62.5MHz
- 67dB @ 100MHz
- e. Mutual Maximum Capacitance of Any Pair 14pf/feet
- f. Worst Pair "NEXT" Loss Per/328-feet (100 meters)
 - 62dB @ 1Mhz
 - 53dB @ 4Mhz
 - 48dB @ 8Mhz
 - 47dB @ 10Mhz
 - 44dB @ 16Mhz
 - 42dB @ 20Mhz
 - 41dB @ 25Mhz
 - 40dB @ 31.25Mhz
 - 35dB @ 62.5Mhz
 - 32dB @ 100Mhz
- 3. ScTP, all the wires in the cable shall be enclosed in a common, 100% metallic foil shield with copper "drain" wire, shield and drain wire located under the cable jacket.

2.07 COPPER WIRE CABLES (COAXIAL)

- A. General
 - 1. An overall non-conductive jacket shall encase the copper wires and shielding.
 - 2. Cables shall be UL listed, complying with NEC National Electrical Code, National Fire Protection Agency and NFPA Requirements for each installation location shown. ETL tested and certified to comply with or exceed Specified Requirements. In addition to the UL listing Requirements for Copper wire Cables twisted pair, coaxial cable shall additionally be UL listed and labeled for each install location.
 - a. NEC - CATVP (Plenum type locations and locations where not continuously enclosed inside conduit).
 - b. NEC - CATVR (Vertical riser type locations).
 - c. NEC - CATV (Locations where continuously enclosed inside conduit).
 - d. ANSI/TIA/EIA-568C; including related Standards, Amendments, and TSB.
 - 3. Electronic network systems infrastructure cables that are not installed inside conduit raceways. Electronic network systems infrastructure cables that are installed in concealed spaces including plenums and non-plenums; access floors, ceiling spaces, walls, floor, etc., and/or installed without continuous raceways. The cable insulation and jacket shall be listed and labeled "Limited Combustible Cable" (LC or LCC) and shall comply with the latest published revision of all the following Additional Requirements.
 - a. Limited combustible "FHC-25/50" per UL-2424.
 - b. NEC/CEC; CMP, additional listing/labeling where the install location is an environmental air plenum, "FHC-25/50-CMP".
 - c. NFPA-90A; ceiling cavity plenums, wall cavity spaces and raised floor cavity plenums, limited-combustible.
 - d. NFPA-5000; defines combustible material including wire and cable.
 - e. NFPA-75 computer rooms and electronic equipment room.
 - f. NFPA-13; spaces containing "limited combustible loading".

4. Cables shall qualify as 100% recyclable materials disposal, RoHS Regulation complaint.
5. The outer cable jacket shall be imprinted with date, Manufacturer's model and catalog number and agency (AHJ) listing identification.
6. Cables installed in air plenums, air-handling spaces and cables installed without raceway or conduit shall be UL listed and labeled for installation in air plenums.
7. Cables installed in raceways or conduits below grade, through in-grade man-holes and pullboxes shall be rated for installation in water/wet locations.
8. Copper wire Electronic Network Systems Infrastructure cable shall be product of the same Manufacturer, including portable patch cables.

B. RG6 Coaxial Cables

1. ANSI/TIA/EIA-568C cables. RG-6, Quad-Shield cables, shall be tested and shall pass ANSI/TIA/EIA test recommendations for the cable type. Rated for both analog and digital RF signal circuits.
2. Operational characteristics:
 - a. Single center conductor size 18AWG stranded or solid bare copper.
 - b. Velocity of propagation not less than 82%.
 - c. Impedance 75-OHM.
 - d. Maximum signal attenuation per 100-feet.

• Baseband Video	0.26dB @ 1MHz
• Upstream Digital Cable	0.76dB @ 10MHz
• TV ch. 2	1.46dB @ 50MHz
• FM Radio	2.05dB @ 100MHz
• TV Ch. 12	2.83dB @ 200MHz
• CATV Ch. 54	4.05dB @ 400MHz
• CATV Ch. 109	5.60dB @ 700MHz
• CATV Ch. 142	6.23dB @ 900MHz
• DBS	6.59dB @ 1000MHz
• DBS	7.50dB @ 1200MHz
• DBS	8.04dB @ 1450MHz
• PCS Cell Phones	8.50dB @ 1800MHz
• Wireless Cable	9.00dB @ 2200MHz
• High Frequency	13.7dB @ 3000-4500MHz
 - e. Capacitance 16.2 pf/feet
 - f. ASTM-D4566, 5 thru 4500MHz Return Loss Headroom (RLH) not less than 20dB.
 - g. 100% sweep tested 5MHz thru 4500MHz
3. Four alternating layers of metal foil shielding and brass braiding shielding, 100% metallic shielding below the jacket and symmetrically enclosing the individual layers of dielectric insulation surrounding the center conductors.

2.08 FIBER OPTIC FIBER SPLICES

A. General

1. Fiber optic cable splices shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
2. Fiber optic splices shall be the product of the same Manufacturer.

- B. Mechanical Splice
 - 1. Mechanically splice each fiber with a splice suitable for use with the type of fiber optic fibers. Re-enterable and reusable splice. Splice shall be recommended as compatible with the optical fibers by the Manufacturer. Splice shall not require the use of adhesives. Splice shall provide integral strain relief.
 - 2. Performance Requirements after installation:
 - a. Operating temperature range minus 20-degrees centigrade through plus 60-degrees centigrade.
 - b. Loss variation over temperature range, 0.05dB or less at specified wave lengths.
 - c. Insertion loss, 0.3dB or less at specified cable wave lengths.
 - d. Reflection (return loss), -40dB at specified cable wavelengths.
- C. Fusion Splicing
 - 1. Fusion splicing shall be performed with equipment providing the following features:
 - a. Cleaving and cleaning optical fiber.
 - b. Integral splice optimization verification system with local injection and detection.
 - c. Projection screen optics and fiber core alignment system.
 - d. Fiber cleaning/stripping.
 - e. Cleaning fiber ends and fusing of fiber together with an electric arc.
 - 2. Fusion splice insertion loss as measured at the completion of the splice shall be less than 0.1dB at specified cable wave lengths.

2.09 FIBER OPTIC FIBER CONNECTORS AND INTERCONNECTION COUPLERS

- A. General
 - 1. The connectors and interconnection couplers shall be compatible, maintain the same Performance Category rating and be compatible with the corresponding fiber optic cable type attached to the connectors.
 - 2. Fiber optic cable connectors and interconnection couplers shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. Connectors and couplers shall comply with ANSI/TIA/EIA-568C, related Standards, Amendments, TSB, and TIA/EIA-Fiber Optic Connector Intermateability Standard (FOCIS) documentation.
 - 3. Fiber optic connectors and couplers shall be the product of the same Manufacturer.
 - 4. Shall be UL listed and comply with UL94V-0.
 - 5. Color code connectors for fiber optic cables to match the respective fiber optic strand/jacket color.
- B. Fiber Optic Fiber Connectors
 - 1. LC – Small Form Factor (SFF) termination connector
 - a. Ceramic oxide 1.25mm ferrule. Mechanical durability not less than 500-mating cycles. Insertion loss of mated connector shall be less than 0.3dB at specified wavelengths.
 - b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match the connector installation application. Provide duct cover cap for each connector.
 - c. Locking type to automatically align mating fibers in the fiber cable and prevent accidental rotation and pullout.

2. ST type bayonet termination connector
 - a. Ceramic aluminum oxide 2.5mm ferrule, multi-cure ultraviolet or heat cured epoxy bonded, for multimode or single mode to match cable fiber. Insertion loss of each mated connector shall be less than 0.3dB at specified wavelengths.
 - b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match the connector installation application. Provide dust cover cap for each connector.
 - c. Locking type, to automatically align fiber cable and prevent accidental pullout.
 3. SC – Square/Subscriber termination connector
 - a. Ceramic oxide 2.5mm ferrule.
Insertion loss of mated connectors shall be less than 0.3dB at specified wavelength.
 - b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match connector installation application. Provide dust cover cap for each connector.
 - c. Push-pull snap and lock type to automatically align mating fibers in the fiber cable and prevent accidental rotation and pullout.
 4. "FSD" fixed shroud duplex type termination connector
- C. Fiber Optic Fiber Interconnection Couplers
1. Interconnection couplers shall be "like-to-like" compatible and shall provide "plug-in" coupling of two fiber optic cable connectors terminated with fiber optic fibers front-to-rear "in-line" together. The coupler shall provide interlocking, automatic optical self-alignment of two mating fiber optic connectors.
 2. The centerline to centerline spacing of the interconnection couplers shall allow removal and insertion of portable patch cords, fiber cable connectors for both "single" and "duplex" type fiber adapter connectors without interfering with adjacent connectors.
 3. Patch panel mounted interconnections couplers shall be factory pre-mounted to a modular nominal 0.09-inch thick metal panel, couplers aligned and anchored on the plate.
 - a. The metal panel shall be predrilled for standard EIA mounting in high-density 19-inch wide metal patch panel frames.
 4. Interconnection couplers in workstation outlets shall be installed in outlet boxes with cover plates.
 5. Provide removable dust caps for the front side of each coupler.

2.10 COPPER WIRE OUTLET CONNECTORS

- A. General
1. Connectors shall comply with FCC part-68 Subpart F for gold plating.
 2. Connectors shall be UL listed and shall comply with UL94V-0.
 3. Provide a removable blank dust cover for each plug-in outlet insert. The dust cover shall protect the insert from contamination until a workstation or patch cord is "plugged" into the outlet.
 4. Copper wire outlet connectors shall be color coded to distinguish telephone/voice separately from computer/data. The outlet cover plate shall be engraved to identify telephone/voice, computer/data, and other infrastructure outlets separately.
 5. Copper wire outlet connectors shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified

Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.

6. Copper wire outlet connectors shall be the product of the same Manufacturer.
- B. Universal Outlet Connector (for twisted pair Copper Wire Premise/Workstation Wiring and copper wire patch panels).
1. General
 - a. Connections for twisted pairs copper conductors shall provide a universal outlet connector between the building premise copper wire, and plug-in workstation locations. Patch panel/equipment plug-in connectors. The connector components shall assemble with "snap-in" spring loaded retainers to prevent dislocation during insertion or removal of external plug-in devices.
 - b. The contacts shall be gold plated with a 250 insertion/withdrawal cycle rating.
 - c. Unless specifically noted otherwise the universal outlet connector shall comply with ANSI/TIA/EIA-568C, related Standards, Amendments and TSB.
 - d. Operational characteristics shall match or exceed and shall be compatible with the respective twisted pair's cable.
 - e. A metal ground shield with EMI/RFI metal ground clip shall be provided where shielded cable is connected to the universal outlet connector for each universal outlet connector assembly.
 - f. Each universal outlet connector shall consist of three major components.
 - 1) Universal edge connector assembly.
 - 2) Plug-in adapter inserts.
 - 3) Connector housing.
 - g. Provide snap-in blank removable insert covers for connector installed without plug-in adapter inserts.
 2. Universal edge connector:
 - a. Insulated assembly shall connect to the premise copper wire. The connectors shall be multiple plug type connector contacts, one contact (total of eight contacts) for each individual premise wire connection interconnected to the individual wire terminations.
 - b. Connector shall provide insertion of individual insulated copper wire, gas tight, 110-style punch down/displacement termination, for 22-26 AWG insulated premise wire.
 - c. The edge connector assembly shall provide termination of eight separate wire conductors, twisted or untwisted pairs, solid or stranded, shielded or unshielded, with color codes and numbered identification of each contact. Integral cable/ conductor strain relief to prevent pullout of terminated premise wire conductors.
 3. Plug-in adapter inserts:
 - a. Plug-in adapter inserts shall be internally factory connected to the universal edge connector assembly to adapt the universal connector to the specific outlet type configuration (i.e. "RJ" style computer/data, telephone/voice, (multimedia) modular jacks, etc.).
 - b. Inserts shall be certified for shielded or unshielded wire, to match premise wire type connected to the universal edge connector.
 - c. Inserts shall provide correct pin-to-pin connections, electrical and mechanical matching characteristics for the specific equipment connected to the respective out-let.

- d. Inserts for different infrastructures shall be color coded with different colors from each other, for system identifications.
 - e. Plug-in adapter insert type:
 - 1) Computer/data network systems:
 - a) ANSI/TIA/EIA-568C, female modular jack 8-position/contact "RJ-45" style.
 - 2) Telephone/intercom voice systems:
 - a) ANSI/TIA/EIA-568C female modular jack 8-position/contact RJ-45 style.
 - 3) Multimedia audio/video TV (baseband only):
 - a) ANSI/TIA/EIA-568C female modular jack 8-position/contact RJ-45 style.
 - b) Each multimedia audio/video outlet location provides a Balun to match the circuit impedance of the premise wiring to the multimedia outlet signal type.
 - 4) Intrusion detection/access control systems:
 - a) ANSI/TIA/EIA-568C female modular jack 8-position/contact RJ-45 style.
 - b) Each intrusion detection system outlet location provides a Balun to match the circuit impedance of the premise wiring to the intrusion system outlet signal type.
 - 4. Connector housing:
 - a. Connector housing shall contain the universal edge connector assembly and the plug-in adapter inserts in a rigid assembly. Connector housing shall provide integral cable strain relief for the premise wiring connection.
 - b. The connector housing shall mount to a metal panel, metal device cover plate or plastic device cover plate with spring loaded snap-in retainers. Nominal depth of connector housing behind the mounting panel and/or device cover plate shall not exceed 1.625-inch including Premise Wiring Termination Depth Requirements.
- C. Coaxial Cable Connectors
- 1. General
 - a. BNC type connectors, for coaxial cable premise/workstation wiring and coaxial cable patch panel equipment.
 - b. Unless noted otherwise, the BNC connectors shall comply with ANSI/TIA/EIA-568C and related Standards, Addendums and TSB.
 - c. Brass body and male contact. Beryllium copper or bronze female contact. Bayonet coupling with threaded or cam-locking mating connection.
 - 2. Operational characteristics shall match or exceed and shall be compatible with the respective coaxial cable. 75-OHM, operational frequency range 0-4500MHz.

2.11 FIBER OPTIC FIBER DISTRIBUTION ENCLOSURES

- A. General
 - 1. Fiber optic fiber distribution enclosures shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
 - 2. Fiber optic fiber distribution enclosures shall be the product of the same Manufacturer.

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B. Equipment Rack Mount Fiber Optic Termination Distribution Enclosure - RTDE

1. The RTDE enclosure shall mount in an EIA Standard 19-inch wide enclosed or open frame equipment rack assembly. The RTDE enclosure shall be metal, painted finish, Manufacturers standard color.
2. The RTDE shall provide the following self-contained functions internal to the RTDE assembly.
 - a. Fiber cable termination.
 - b. Fiber cable "pig-tail" splicing.
 - c. Fiber cable patch panel.
 - d. Fiber cable management, training, and strain relief.
 - e. Individual fiber and patching port identification numbers, color-coding of incoming trunk and out-going distribution fiber ports.
 - f. Plug-in fiber optic interconnection couplers for port to port patching with portable fiber optic patch cords.
3. Fiber splice drawers:
 - a. Horizontal sliding metal drawers adjustable to approximately 30-degree angle when fully open, and removable for easy access. Each drawer shall contain two fiber optic splice trays with tray holders.
 - b. Drawers shall stack vertically one above the other in the RTDE and allow sufficient slack in all fiber cables for removal of the drawer and splice trays.
 - c. Provide one sliding drawer and two splice tray assemblies for each group (24-individual fibers or fewer fibers per group) of fiber optic fibers terminated in the equipment rack, but in no case provide not fewer than two sliding drawers with splice tray assemblies in each RTDE.
4. Fiber cable patch panel
 - a. Metal panel shall provide a patch port for each fiber consisting of metal panel mounted fiber optic interconnection couplers for each fiber optic fiber indicated to be terminated at the RTDE.
 - b. The fiber optic fiber interconnection coupler shall be provided to match and be compatible with the fiber cable connectors. Quantity shall match quantity of terminated fibers, unless indicated otherwise on the equipment rack schedules.
 - c. Nominal panel thickness 0.09 inches.
 - d. Provide a minimum of sixteen unused spaces for additional couplers in the patch panel.
5. Nominal height of the RTDE shall not be exceeded, as follows:

<u>Quantity of Patch Ports</u>	<u>Quantity of Splice Drawers</u>	<u>Nominal Height</u>
24	2	11-inches
48	2	11-inches
72	3	14-inches
144	6	28-inches

C. Equipment Rack Mount Fiber Optic, Splice only (for use only where fiber patch panel is not required) enclosure - RMSE

1. The RMSE enclosure shall mount in an EIA Standard 19-inch-wide enclosed or open frame rack assembly. The enclosure shall be metal, painted finish, Manufacturer's standard color.
2. The RMSE shall provide the following self-contained functions internal to the RMSE assembly:
 - a. Fiber cable splicing for "thru splicing" of fiber optic cables where the cables do not terminate in the equipment rack.

- b. Fiber cable management, training, and strain relief.
3. Fiber splice drawers
 - a. Horizontal sliding metal drawers adjustable to approximately 30-degree angle when fully open and removable for easy access. Each drawer shall contain two fiber optic splice trays with splice tray holders.
 - b. Drawers shall stack vertically one above the other in the RMSE and allow sufficient slack in all fiber cables for removal of the drawers and splice trays.
 - c. Provide one sliding drawer and two fiber optic splice tray assemblies for each group (24-individual fibers or fewer fibers per group) for fibers optic fiber routed through but not terminated in the equipment rack, but in any condition provide not fewer than two sliding drawers with splice tray assemblies in each RMSE.
4. Nominal height of the RMSE shall not be exceeded, as follows:

<u>Quantity of Thru Splices</u>	<u>Quantity of Splice Drawers</u>	<u>Nominal Height</u>
24	2	4-inches
48	2	4-inches
72	4	8-inches
96	4	8-inches

2.12 COPPER WIRE PATCH PANELS

- A. General
 1. Copper wire patch panels shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
 2. Copper wire patch panels shall be the product of the same Manufacturer.
- B. Equipment Rack Mounted Patch Panel
 1. Standard EIA 19-inch wide metal panel, Manufacturers standard color. Pre-punched for copper wire outlet connectors. Panel shall mount on an EIA Standard 19-inch-wide enclosed or open frame equipment rack assembly. Nominal 24-copper wire outlet connectors in a horizontal row, quantity of rows as required for total quantity of connectors. Provide not less than two spare empty rows for future copper wire outlet connectors.
 2. The patch panel shall provide the following self-contained functions.
 - a. Copper wire cable termination including conductor/shield termination and strain relief.
 - b. Plug-in copper wire outlet connectors for port to port patching with copper wire portable patch cords.
 3. Patch panel height shall be based on the quantity of copper wire outlet connectors described plus the specified space for future outlets and shall not exceed the following dimension height:

<u>Outlet Quantity</u>	<u>Nominal Patch Panel Height</u>
1-24	3.5 inches
25-48	7 inches
49-72	10.5 inches
73-96	14 inches
 4. Horizontally mounted, cable support metal bracket shall be provided for each 24-outlet/connector groupings. The brackets shall be bolted to the equipment rack located at the backside of the patch panel; the brackets shall support and

- provide strain relief for each incoming copper wire cable connecting to the patch panel.
5. The copper wire connector installed in the patch panel shall be the same configuration, Manufacturer and type as the corresponding copper wire connector provided in the remote workstation outlet locations connecting to the respective patch panel outlet, unless indicated otherwise.
 6. Each multimedia, audio/video/TV multimedia and intrusion detection/access control out-let. Provide a Balun, to match the circuit impedance of the premise wiring and to the outlet signal type.

2.13 TELEPHONE/VOICE TERMINAL BLOCKS

A. General

1. Terminal blocks Type 110, shall consist of wiring blocks, connecting blocks, direct wire/patch cord cross connection and designation strips. Arrange in unitized, modular, vertical mounting sections, for telephone/voice.
2. Completely 100% front accessible for cross connections, terminating conductors, training, and fanning of cables. Rear access for any reason shall not be permitted.
3. Telephone/voice terminal blocks shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. Tele-phone terminal blocks and connections performance shall comply with ANSI/TIA/EIA-568C and related Standards, Addendums and TSB and shall comply with and be listed under UL 1863. Category rating shall match the cables connecting to the patch panel.
4. The telephone/voice terminal blocks shall provide cross connection of telephone/voice four pair premise copper wiring from telephone/voice handset outlets to multiple copper wire telephone/voice feeder cables and external free standing telephone equipment.
5. Each full height vertical section terminal block assembly shall terminate a minimum of 900 pairs (including specified spares for future construction phases) of telephone/voice conductors, plus associated cross connection wiring and patch cords in a nominal 20-inches wide by 90-inches high space. Provide multiple vertical sections of terminal block assemblies adjacent to each other, total quantity as required for quantity of telephone/ voice conductor pairs and telephone/voice feeder cable pairs shown on the Drawings and Requirements, plus specified spares.
6. Each telephone/voice terminal block vertical section assembly shall provide 15% or 100 (whichever is the larger quantity) of spare unused conductor pair terminals for future telephone/voice connections.
7. Provide a common ground bus in each terminal block section with a minimum of six ground conductor termination positions, #10AWG through #6AWG.
8. Terminal blocks shall be the product of the same Manufacturer.

B. Wiring Blocks

1. One piece molded, die-electric thermoplastic blocks. The wiring block shall support and secure all the components of the terminal block assembly and provide cable/conductor training and organization.
2. Fire retardant complying with UL 94V-0.
3. Standoff type support legs for mounting to backboard with pre-drilled anchor holes.
4. Non-conductive electrically quiet front assembly.

5. Horizontal index strip rows, for termination of not less than 25-conductor pairs on each row. Color coded and marked in groups of four pairs or five pairs to match connecting cables.
 6. Removable retainers at the ends of each horizontal connecting block index strip row, shall support cross connect wires at corner turns.
 7. Distribution rings shall retain cross connect wire horizontal routing between terminations.
 8. A full width, horizontal trough between each 100 pair wiring block shall provide a path for patch cord training and retention.
- C. Connecting Blocks
1. Connecting blocks shall provide gas tight conductor electrical connections with conductor insulation displacement punch down slots, for insertion onto the telephone/voice wiring block index strips.
 2. Connecting blocks shall electrically connect one-to-one between each conductor terminated at the wiring block index strips, and each cross connect / patch cord conductor terminated/connected to the opposite front side of the connecting block.
 3. Both sides of the connecting blocks shall terminate telephone/voice UTP 22-26AWG stranded or solid copper wire individually insulated conductors. The front side of the connecting blocks shall also provide "plug-in" connections for portable patch cords, 110 style "plug-in" connectors.
 4. Connection blocks shall be 4-pair insulated copper conductor type.
 5. Provide insulated, removable termination caps for each connector block.
 6. Connector blocks shall be marked to indicate tip and ring conductors and to indicate polarization.
- D. Designation Strips
1. Designation strips shall provide retention of interchangeable labels. The labels shall show circuit identification of each terminated conductor pair.
 2. The designation strips shall mount on the center and outside positions of the wiring block.
- E. Telephone/Voice Cross Connection
1. The cross-circuit connection between incoming and outgoing feeder cables and telephone voice outlet wiring shall be provided in the terminal block assembly.
 2. The cross-connection wiring shall terminate incoming and outgoing circuit conductors between respective connecting blocks.
 - a. Direct connect cross connection shall provide internally wired one-to-one conductor twisted pair cross connection. Provide cross connection of each 4-pair telephone/voice outlet cable to corresponding 4-pairs of the telephone/voice feeder cable and cross connection of feeder to feeder cables, as applicable.
 - b. Patch panel cross connect, 110 terminal connector style, plug-in. Provide one twisted pair, 110 connector type portable patch cords.
 - c. Prewired 50-pin Amphenol connectors:
 - 1) Provide factory prewired 50-pin Amphenol connectors for connection from telephone/voice terminal blocks to the Telephone Switch Equipment and Tele-phone Utility Company outside telephone service lines.
 - 2) Provide fifty pair ANSI/TIA/EIA-568C and related Standards, Addendums and TSB cables, connected to 50-pin Amphenol connectors at one end (telephone equipment connection) and

- connected to the respective telephone/voice terminal wiring blocks at the other end.
- 3) The 50 pin Amphenol connectors shall group together and be positioned at the top of the respective terminal block section near the ceiling.
 - 4) The pin-to-pin conductor assignments shall conform to the Telephone Switch Manufacturer's Requirements.
 - 5) The Amphenol connector/cable assemblies shall connect to and extend the telephone/voice outlet premise wiring from telephone/voice terminal block to the telephone switch equipment. The Amphenol connector/cable assembly shall connect to and extend the Telephone Utility Company outside telephone service lines to the telephone switch equipment.
- d. Prewired "RJ" style modular jacks
- 1) Provide factory prewired eight position/contact plug-in "RJ" style jacks for patch panel portable patch cord cross connects, located on the front side of the terminal blocks.
 - 2) The pin-to-pin conductor assignments shall conform to the Telephone Switch Manufacturer's Requirements.

2.14 EQUIPMENT RACK

A. General

1. An equipment grounding bus, nominal 19-inches long, UL labeled as a ground terminal bus, shall be provided on each equipment rack. The ground bus shall be bolted to the rack main metal frame member with 1-inch standoff non-insulating bolts. Provide a minimum of ten drilled and taped bolt holes in the ground bus with ground lug bolts, for connection of equipment grounding conductors to the ground bus, size to accept ground conductors #14-#4AWG.
2. Vertically mounted, cable management metal rings (aluminum or stainless steel) shall be provided full height, continuously along the front and rear of each vertical rail of the equipment rack. The rings shall be bolted to the equipment rack. The rings shall train and dress portable patch cords connecting between outlet connectors located in the equipment rack or in adjacent equipment racks.
3. Provide horizontal cable management panels with multiple cable training rings on each panel (not less than five rings for each panel). Management panels (for up to 24-outlet grouping) nominal 19-inches wide by 1.75-inches high by 3-inches deep and/or (for up to 48-outlet groupings) 3.5-inches high by 3 inches deep, for EIA rack installation. Rings shall provide horizontal routing and support by grouping portable patch cords connecting between patch ports in the same equipment rack or adjacent racks. Patch cords shall be grouped and bundled with "Velcro" tie wraps and shall not overlap patch fields or rack mounted equipment.
The cable management panels shall be installed on both the front and rear of the equipment racks, mounted both above and below horizontally between groups of patch ports as follows:
 - a. One cable management panel (front and rear of rack) for each group of forty-eight or less copper wire outlets for patch ports.
 - b. One cable management panel (front and rear of rack) for each group of forty-eight fiber optic outlet patch ports.

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4. The entire rack assembly including any support arms shall comply with Seismic Earthquake Requirements for install location structural standards.
 - a. The assembly shall provide support for the weight of the equipment installed on the rack, but in no case less than 500-pounds of equipment, plus the weight of the rack and connecting cables. A 2.0 time's safety factor shall be included in the equipment rack assembly structural design.
 5. Provide plug strip Surge Protection Device with RF Suppressor (SPD) and Power Distribution Units (PDU). Horizontal strip mounted in each equipment rack. Each unit shall contain not less than six "plug-in" on the rear of the SPD and not less than two plug-in on the front of the SPD protected outlet plugs.
 - a. Provide two SPD/PDU units in each equipment rack, to supply "dual-corded" equipment.
 6. Provide pre-drilled mounting holes the entire length of equipment vertical mounting frames, EIA-310D-19 inch (nominal) wide standard spacing for indicated equipment. Racks shall provide 17.75-inches (nominal) equipment horizontal mounting space between vertical rails.
- B. Mini-Equipment Racks Sectional – Surface Wall Mount
1. The mini-equipment rack shall be fully metal enclosed, tamper resistant, wall surface mounted, multiple section construction. The rack shall consist of three sections; a fixed wall mounting pan; a hinged center section and a hinged door. The rack shall provide a minimum of 26-clear internal depth for mounting of equipment inside the rack. Provide brackets inside the pan for stress relief, training/ lacing, support of cables.
 2. The mini equipment racks nominal dimensions shall be as follows:
 - a. Overall depth 30-inches.
 - b. Overall width 22-inches.
 - c. 30-inch minimum overall height, for termination of up to a quantity of 48-copper wire workstation patch panel outlets and up to a quantity of 18-individual fiber strands combined, into the mini-equipment rack.
 - d. 48-inches minimum overall height, for termination of up to quantity of 96-copper wire workstation patch panel outlets and up to a quantity of 18-individual fiber strands combined, into the mini-equipment rack.
 3. Fixed wall, surface mounted pan section, nominal 3 inches pan depth, metal enclosed on all sides and back, open front; shall anchor the rack to the wall; provide support for the hinged center rack section and provide knockouts for side/top/bottom and rear conduit /raceway entrances.
 4. Center section, metal enclosed on all sides, open front and rear, nominal 18-inches depth, full height and width hinged attachments to the pan-section, to provide hinged 90 degrees open-close operation of the center section on the pan and allow access to the front and rear of equipment and terminations mounted inside the center section. Two internal vertical, front mounted, pre-drilled equipment mounting frame rails. Self-locking with release latch, accessible only from inside cabinet.
 5. Front access door section, metal, full height, and width hinged 90-degree open-close operation attached to the center section. The door shall allow for nominal 3-inches minimum of interior projections extending from the front face of the internally mounted equipment located behind the front access door when the access door is in the closed position. Key-locking front of door exterior access. Smoke/gray impact resistant, tamper resistant see-through windows in the door front.
 6. Minimum 16-gauge metal, fully welded construction; Manufacturer's standard rust inhibitor "prime" base coating, with "finish" color black or as selected by

Architect. The equipment racks shall provide support for the weight of the equipment installed in the rack, but in no case less than 200 pounds of equipment plus the weight of the rack and connecting cables.

7. Provide two 120-volt 60Hz AC motor direct driven air ventilation, "muffin" style, nominal 4-inches square, exhaust air fans. Flush mount fans in the top of each equipment rack. The fans shall be low speed, low noise type with wire guards to prevent contact with the fan blades. The fan motor shall be high impedance, self-protecting type motors. Provide "SO" cord with plug caps to connect from the fans to the 120-volt plug-strip inside the equipment rack.
8. Provide cooling air intake louvers with removable air filters and air filter holder, mounted in the bottom of the rack. The louver shall be protected with internal screening to prevent the intentional insertion of foreign objects into the housing.
9. The mini-equipment rack shall be easily convertible in the field, to allow for "left" or "right" center section and/or door section hinge operation. Provide a minimum of two key-locks on each hinged section to prevent unauthorized access into the unit. Provide gasketing on all "mating" cabinet interfaces to insure proper cooling air flow through the air filters.
10. Mini-equipment racks as manufactured by Middle Atlantic Products Inc.; or B-Line; or Hoffman/Pentair.

C. Plug Strip Surge Protection Device (SPD).

1. General

- a. Self-contained unit combining plug-in receptacle strip and SPD. Rated 20-amp, nominal 120-volt +10%, 60Hz, AC, 2400 watts full continuous load. Internal 20-amp resettable overload protection circuit breaker. Red illuminated on-off switch. 9-foot, 12AWG 3-conductor grounded, high abuse heavy duty jacketed AC, line cord with NEMA 5-20P cap.
- b. Multi-outlet receptacles, suitable for use with the following types of plug in loads; data processing equipment, audio/video equipment, test instruments, medical equipment, photo graphic equipment and "switching type" power supplies.
- c. Protected 120-volt outlets shall be NEMA 5-15R 15 amp, or 20-amp NEMA 5-20R AC 60Hz receptacles, as applicable for connected equipment loads. Provide not less than eight protected outlet plugs on each unit. Each individual or group of two receptacles (duplex) shall be connected to separate protected load isolated filter banks.
- d. Each duplex shall be isolated from the other output receptacles, minimum isolation of 25dB at 1MHz line to line, line to neutral, line to ground and neutral to ground.
- e. Non-blocking plug-in locations/orientation, for plug-in self-contained "power-brick", equipment power supplies.
- f. As manufactured by Liebert, or TRIPP LITE.

2. Operation

Self-contained RFI and EMF shielded housing with mounting slots for temporary mounting of the unit. Protected outlet receptacles shall supply over current protected and filtered, electrical line voltage power to the connected equipment. Line noise RFI and EMI interference filtering suppression, surge protection and spike protection shall occur in all three modes of operation line to ground, line to neutral and neutral to ground rated as follows:

- a. 13,000-amp, 210 joules (watt-seconds) peak withstands capacity.
- b. Surge response time less than 5-nano seconds.

- c. 140-volt AC RMS initiate spikes suppression 330 volt maximum let through.
 - d. RFI and EMI Suppression-Provide spectrum analysis test dB attenuation reports showing RFI filtering over specified frequencies.
 - e. Diagnostic indicator lights located on the SPD housing shall provide alarm alert for each of the following conditions:
 - 1) Loss of AC power.
 - 2) Damage, malfunction in the SPD suppression circuits.
 - 3) Improper AC electrical outlet wiring.
 - f. Standards Testing, Listing and Certification Compliance:
 - 1) IEEE 587 A and B compliance.
 - 2) UL 1449 surge suppressers.
 - 3) UL 1363 temporary power taps.
 - 4) UL 1283 electromagnetic interference filters.
3. Rack Mounted SPD
- a. SPD units installed in equipment racks shall comply with all of the same Performance Requirements including as follows.
 - 1) EIA/TIA – Equipment rack horizontal mount style (19-inches or 24-inches as applicable).
 - 2) Minimum of two front mounted outlets and not less than six rear mounted outlets.
 - 3) Position in each equipment rack as directed by Owner's Representative.
 - 4) Provide two SPD units in each equipment rack, for "dual-corded" network equipment.
- D. Power Distribution Unit (PDU)
- 1. General
 - a. Self-contained unit combining main circuit breaker, multiple plug-in individual circuit breaker branch protection load receptacles, PDU metering status monitoring and network communication. All PDU components self-contained in a NEMA-1 metal enclosure.
 - b. Non-blocking plug-in locations oriented for plug-in self-contained "power-brick" equipment supplies.
 - c. Standards Testing
 - 1) UL 60950-1 Information Technology Equipment.
 - 2) CAN/CSA-C22.2 No.60950-1-03 Information Technology Equipment.
 - 3) FCC, Title 47, Part 15 Subpart B for Class B operation as defined by ANSI Standard C63.4.
 - 4) ROHS Complaint.
 - 5) ISTA Procedure 1A and 2A.
 - d. Provide two PDU units in each equipment rack, to supply two SPD units in each equipment rack.
 - e. Shall be a product of the same Manufacturer as the SPD unit. As manufactured by Liebert, or TRIPP LITE.
 - 2. System Description
 - a. Remote monitoring and/or control capabilities for power distribution at each load/equipment rack level. For data/network equipment line voltage plug-in and SPD line voltage plug-in electrical distribution.
 - b. PDU shall meter and monitor electrical attributes of an individual Rack PDU, including real-time remote and local display of monitoring of aggregate and branch electrical parameters (status, thresholds, alarms)

- including voltage, ampere, and kW. Rack equipment PDU and Branch load monitoring and control.
- c. Self-contained metering and communications
 - 1) Local display ampere-meter demand load meter to monitor plug-in demand load and total PDU load.
 - 2) Digital Fast Ethernet LAN RJ-45 communications port for Ethernet SNMP and IP network monitoring of electrical status. Multi-user site-wide software license, compatible with PC-computer and IP-WEB HTTP protocols.
 - 3) Provide network array-interface for connection of multiple PDU units positioned in the same location.
- d. Nine-foot input power (heavy duty high abuse) cord with appropriate conductors and input NEMA plug-in connection. Provide input overload protection with Hydraulic-Magnetic main input circuit breaker. Provide load output NEMA plug-in branch connection with overload circuit breaker protection for each load receptacle.
- e. Equipment rack mounting horizontal position form factor.
- 3. Electrical Power ratings shall be as follows and as additionally indicated on Drawings. Refer to Drawings for twist-lock verses straight-blade configurations.
 - a. Single main input circuit breaker 30 amp, 208/120 volt 3-phase 5-wire "WYE" grounded 60Hz AC.
 - b. Branch load circuit breakers with a single plug-in receptacles for each load circuit breaker. Balance loads on each circuit phase.
 - 1) Three 20 amp 1-pole circuit breaker and three NEMA 5-20R receptacles. Also provide matching caps.
 - 2) One 30 amp 2-pole circuit breaker and one NEMA 14-30R receptacle. Also provide matching cap.
 - 3) Additional circuits and receptacles as indicated on Drawings.
- 4. Provide heavy duty high abuse flexible copper wire 300-volt insulated 15-foot long jacketed electrical cord. Connect from PDU to wall-outlet receptacle with same electrical rating as PDU. Rated for PDU voltages and amperes.
- 5. PDU units installed in equipment racks shall comply with all of the same Performance Requirements including:
 - a. EIA/TIA – equipment racks horizontal mount style (19-inches or 24-inches) as applicable.
 - b. Position in each equipment rack as directed by Owner's Representative.
- 6. Provide two Category-6A 4-pair UTP 15-foot long portable patch cable connects, PDU to respective network patch panel port.

2.15 WALL MOUNT FIBER OPTIC CABLE INTERFACE CABINET (WMIC)

- A. General
 - 1. Metal (14 gauge) enclosure, with full height hinged metal door. Door shall be pad lockable. Nominal size 12-inches deep by 18-inches wide by 36-inches high. Enclosure shall mount directly on the wall.
 - 2. WMIC shall be UL listed, complying with National Electrical Code, ETL Tested and Certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
 - 3. Interface cabinets shall be the product of the same Manufacturer.

- B. The WMIC shall provide the following self-contained functions internal to the WMIC enclosure.
 - 1. Fiber cable splicing for "through splicing" of non-UL listed fiber optic cables, where the cables do not terminate in the building.
 - 2. Fiber cable management, training, and strain relief.
 - 3. Transition from non-UL flame spread listed fiber optic cable, to UL flame spread listed fiber optic cables where the cables terminate in the building.
- C. Cable routing rings shall organize optic fibers in a 360-degree loop inside the WMIC housing and provide cable strain relief.
- D. Fiber Optic Splice Trays
 - 1. Provide fiber optic cable splice trays.
 - 2. Tray holders shall provide mounting and support for each splice tray.
 - 3. Provide two splice trays for each group (24 or less fibers per group) fiber optic fibers routed through the WMIC, but in no case provide not less than four splice trays in the WMIC.

2.16 UNIVERSAL SPLICE ENCLOSURES - USE

- A. General
 - 1. The universal splice enclosure shall provide splicing for multiple cables containing multiple, network copper wire conductors or fiber optic fibers.
 - 2. The enclosure with the connecting cables installed shall be watertight, continuously submersible in up to 10-feet depth of water without leaking water into the enclosure interior.
 - 3. The enclosure with splices shall be completely re-enterable to allow access to the interior splices, adding cables, and removing cables, without compromising the watertight integrity of the enclosure.
 - 4. The universal splice enclosure assembly shall be UL listed.
 - 5. The USE shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/ TIA/EIA-568C including related Standards, Amendments and TSB.
 - 6. USE shall be the product of the same Manufacturer.
- B. Fiber Optic Splices
 - 1. Provide fiber optic splice trays inside the USE. Each splice tray shall provide space for up to 12 splices in lieu of 24-splices on the tray.
 - 2. A splice tray holder shall rigidly anchor splice trays inside the USE, with sufficient slack cable, to allow individual removal of each splice tray.
 - 3. Provide one splice tray for each twelve fibers passing through the USE, but not less than eight splice trays in the use enclosure.
- C. Copper Wire Splices

2.17 SPLICE TRAY FIBER OPTIC FIBERS

- A. General
 - 1. Trays shall be suitable for installation in USE, WMIC, RMSE and RTDE enclosures.
 - 2. The trays shall be the product of the same Manufacturer as the respective enclosures.

3. Splice trays shall be UL listed, complying with national Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
- B. Splice Trays
1. A metal or non-metal splice tray shall provide space for up to 24-splices of individual fiber cable single mode and multimode optical fibers. The trays shall provide individual splice holder inserts for each splice to adapt the tray for mechanical or fusion splices, with or without splice sleeves.
 2. The tray shall incorporate integral fiber tie down clamps, fiber routing rings, provide strain relief and two full 360-degree fiber loops around the tray perimeter with sufficient slack fiber for removal of the tray for access and splicing of the fiber cable. The tray shall insure the minimum bending radius of the optical fibers is not violated.
 3. Provide a removable clear plastic tray top cover for each tray, to protect and isolate the fibers.

2.18 WORKSTATION OUTLETS

- A. General
1. Engrave outlet cover plates with the port number corresponding to the port number at the respective terminal block, patch panel, or head-end equipment.
 2. The outlet cover plates shall be factory pre-punched and formed to accommodate the installed outlet connector with attachment screws.
 3. Workstation outlets shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
 4. Workstation outlets shall be the product of the same Manufacturer.
- B. Computer/Data Workstation Copper Wire Outlets
1. The outlets shall be the same configuration and type as the corresponding connector provided in the copper wire patch panel outlet, unless noted otherwise.
 2. ANSI/TIA/EIA-568C, and related Standards, Addendums and TSB.
 3. The copper wire outlet connectors for twisted pair wire connections in computer workstation outlets shall be universal outlet connector RJ-45 type.
- C. Telephone/Voice Handset Twisted Pair Wire Connection Workstation Outlets
1. The copper wire outlet connectors provided in telephone/voice handset outlets, shall be universal outlet connector type, unless noted otherwise, ANSI/TIA/EIA-568C and related Standards, Addendums and TSB.
 - a. RJ-45 type
- D. Fiber Optic Workstation Outlets
1. The fiber optic outlet connectors workstation outlets shall be fiber optic fiber interconnection couplers, installed in universal outlet connectors. Provide one coupler for each fiber connecting to the outlet, but in no case less than the following for each outlet and as shown on the Drawing:
 - a. Computer workstation data network two couplers and fiber connectors.
 - b. Data network server - four couplers and fiber connectors.
 2. The universal outlet connector housing and cover plates shall be the same as copper wire outlet connectors, except with adapters for fiber optic interconnection couplers, for the fiber optic fibers plug-in connectors.

3. The centerline-to-centerline spacing of the inter-connection couplers shall provide for "plug-in" insertion of "single or duplex" fiber connectors.
4. Color-code and identify the "in"-receiving and "out"-transmitting position for each inter-connection coupler.

E. Outlet Boxes

1. General for Low Voltage Outlets Requirements
 - a. Shall be UL approved and labeled for Life-Safety Appliances.
 - b. UL listed and label for low voltage CEC/NEC class-2 wiring and devices.
 - c. Shall be adjustable to fit into the wall/ceiling and attach into the wall/ceiling thickness at each install location.
 - d. Provide cable "Strain-Relief" attachment and "Sharp-Edge" protection for each outlet cable connections.
2. Wall mounted
 - a. Flush or surface wall mounted outlet box and size as indicated on the Drawings, but in no case less than 4.69-inches by 4.69-inches by 2.125-inches deep.
 - b. Two gang wide extension ring for outlet box to extend outlet flush with finish surface, or as noted on the Drawings.
 - c. Two gang wide cover plate, or as noted on the Drawings.
3. Inside flush floor boxes and other locations where indicated in the Contract Documents.
4. Low Voltage Outlets in Fire rated walls and ceilings
 - a. Provide metal outlets for low voltage devices installed (recessed into) in fire rated walls or fire rated ceilings.
 - b. Provide metal outlet box enclosed type, for each outlet location. Provide UL labeled and listed "Fire-Wrap" complete coverage protection on the exterior of each outlet box. The combined outlet box and "Fire-Wrap" protection shall be equal or greater than the respective wall or ceiling fire-rating location.
5. Low Voltage Outlets in Non-Fire Rated walls and ceilings
 - a. Outlets for low voltage devices installed (recessed into) walls or ceilings, only where the wall/ceiling is not fire-rated.
 - b. Provide the following for each outlet location
 - 1) Metal outlet box, enclosed type. All locations where one or more conduit(s) are required to connect to the outlet, then only metal outlet box shall be provided.
 - 2) Or device mounting bracket with trim ring, without (backless) enclosed outlet box. Do not use bracket-trim/ring configuration where conduit connection to the outlet with conduit is required, provide metal outlet boxes. Shall provide attachment for low voltage device(s), cover plates and low voltage wire strain relief.
6. Low Voltage outlet installed into accessible suspended ceiling with removable ceiling panels.
 - a. Support outlet independent of ceiling supports and ceiling.
 - b. Provide a minimum of three independent hanger wires for each outlet. Attach hanger wires to building structure above ceiling and to outlet.
7. Low Voltage Outlets in existing walls and existing ceilings
 - a. Outlets installed (recessed into) existing walls or (recessed into) existing ceilings. Cut and patch to match existing surfaces for outlet installation.
 - b. Provide "cut-in" retrofit mounting-attachment into existing ceiling/wall construction. Shall be UL rated for retrofit into "old-work".

- c. Provide the following for each outlet location,
 - 1) Metal outlet box, enclosed type. Required for all Fire rated construction locations. Also permitted for non-Fire rated construction locations.
 - 2) Or device mounting bracket with trim ring. Permitted only for non-Fire rated construction locations only where no conduit connection to the outlet is required. Do not use in Fire rated construction locations. Do not use where conduit connection to outlet is required.
 - d. Where the existing wall/ceiling existing fire rating is indeterminate, Contractor shall assume the existing fire rating is not less than 2-hours. Provide metal outlet box and Fire-Wrap for each recessed outlet box.
- F. Multi-Outlet Raceway Workstation Outlets
 - 1. Copper wire outlet:
 - a. Where copper wire connection is indicated for the workstation outlet, provide one universal outlet connector for each outlet.
 - b. Each universal outlet connector shall be single connector housing type.
 - c. Provide a rectangular cutout and metal device plate in the raceway sized to outlet Manufacturer's recommendations. The workstation copper wire outlet shall mount a modular faceplate kit with outlet bezel and faceplate sized to match the workstation outlet.
 - d. Offset the location of outlets for electronic network systems 6-inches in the raceway from other outlets, do not "stack" outlets one above the other in the raceway.
 - 2. Fiber optic outlet.
- G. Combination Outlets
 - 1. Infrastructure outlet connectors shown at the same location for either wall box outlet locations or floor box outlets locations.
 - 2. The outlet connectors shall be installed in a common outlet box with a common cover plate in the respective wall location or floor location.
 - 3. In infrastructure patch panels install the connectors in the respective patch panels.

2.19 PORTABLE PATCH CORDS

- A. General
 - 1. Provide portable patch cords for all copper wire and fiber optic cable infrastructure out-lets:
 - a. For interconnecting electronic network equipment to electronic network workstation outlets.
 - b. For interconnecting equipment rack patch panel outlet patch locations with each other.
 - c. For interconnecting patch panel outlets equipment rack mounted hubs, switches, routers, telephone equipment, A/V equipment, access control and intrusion detection equipment etc.
 - 2. Patch cords shall be factory assembled tested and certified with factory terminated plugs at each end. Field terminated portable patch cords shall not be permitted. Terminated plugs shall incorporate integral bending radius limiting molded "boots" and strain relief. Patch cord assemblies shall be rated for "heavy duty", "high-abuse" service.

3. Patch cords shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. ANSI/ EIA/T1A-568C, related Standards, Addendums and TSB.
 - a. NEC - OFNG/OFN for fiber optic portable patch cords.
 - b. NEC - MPP/CMP/CMR/CMG/MPG for copper wire twisted pair portable patch cords.
 - c. NEC - CATV for coaxial cable portable patch cords.
 4. Patch cords which are not installed shall be delivered to the Owner in card-board boxes. The patch cords shall be neatly bundled and tied together. Mark each box with quantity and type of cords contained in the box.
 5. Patch cords shall comply with the same Cable Communication Performance Requirements, Protocol Requirements and Testing Requirements as the respective infrastructure cables and outlets to which the patch cords are intended to be connected (plug-in). Patch cords shall be the product of the same Manufacturer.
 6. The outer jacket of each portable patch cord shall be imprinted with date, Manufacturer's model, and catalog number and AHJ listing identification.
 7. Provide a permanent, visible, factory applied identification number on each end of each patch cord. The identification number shall be the same on each end. However, the numbers shall increase sequentially on each patch cord and shall be unique and not duplicated on other patch cords. Permanently apply the identification numbers on the cable jacket or connectors.
- B. Twisted Pairs, Copper Wire Portable Patch Cords
1. Twisted Pairs portable patch cords, general:
 - a. "Male" eight position modular "RJ" male style jacks install on each end of the patch cord cable. The jack shall be provided with a rear "fin" to prevent the plug tab from snagging when pulled backwards through adjacent wiring.
RJ-45 style "male" jack, typical unless noted otherwise.
 - b. Patch cord cable shall be UTP and ANSI/EIA-Category rating, shall match respective premise wiring, 4-pair twisted, stranded copper individually insulated wires, thermoplastic jacket over all the wires and shield.
 - c. Connectors shall comply with FCC 68.5 and Part 68 Subpart F.
 - d. Connectors UL listed and shall comply with UL-94V-O.
 - e. Contacts gold plated with not less than a 750 insertion/withdraw cycle rating.
 2. Portable patch cord quantities and lengths for connecting port-to-port equipment rack patch panels
 - a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire equipment workstation outlet patch port in the equipment rack patch panels. One-to-one straight through pin-to-pin wiring. Provide additional spare patch cords, quantity equal to 25% of the total quantity of patch cords provided for copper wire computer workstation outlets in the equipment rack patch panels. Cable jacket color shall be blue:
 - b. Provide the following lengths of copper wire patch cables for copper wire equipment rack patch panel outlets.
 - 1) 2-feet long - 10% of total quantity
 - 2) 4-feet long - 30% of total quantity
 - 3) 6-feet long - 30% of total quantity
 - 4) 10-feet long - 20% of total quantity
 - 5) 16-feet long - 10% of total quantity

3. Portable patch cord quantities and lengths - for connection from equipment workstations to equipment workstation outlets, located remote from equipment racks.
 - a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire workstation outlet located remote from the equipment rack patch panels. Provide additional spare patch cords, quantity equal to 15% of the total quantity of patch cords provided for each copper-wire computer workstation outlets. Cable jacket color shall be blue:
 - 1) Infrastructure network outlet segments the pin-to-pin patch cord wiring configuration and jacks shall be compatible with the equipment protocol communications interface, and the respective workstation outlet.
 - b. Provide the following lengths of copper wire patch cables for equipment copper wire infrastructure network workstation outlets. The patch cords shall provide internal cross-over wiring to conform the pin-to-pin connections required between the equipment workstation outlet and the equipment protocol communications inter-face installed in the respective workstation equipment:
 - 1) 8-feet long - 30% of total quantity
 - 2) 15-feet long - 70% of total quantity
4. Portable patch cord quantities and lengths for connection from electronic equipment rack patch panel ports to equipment installed in equipment racks, such as HUB's, servers, switches, router, telephone, and concentrator equipment ports. Cable jacket color shall be white.
 - a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire outlet port located in electronic equipment. Provide additional spare patch cords, quantity equal to 25% of the total quantity of the equipment rack equipment ports.
 - 1) The pin-to-pin patch cord wiring configuration and jacks shall be compatible with the respective equipment and patch panel outlets as applicable.
 - b. Provide the following lengths of copper wire patch cables for outlet ports located in electronic equipment installed in equipment racks. The patch cords shall provide quantity of conductors, wiring shall conform the pin-to-pin connectors and jack/ connectors to the ports in the equipment mounted in the equipment racks.
 - 1) 4-feet long - 15% of total quantity
 - 2) 6-feet long - 30% of total quantity
 - 3) 10-feet long - 35% of total quantity
 - 4) 16-feet long - 20% of total quantity
5. Portable patch cord quantities and lengths for connection of equipment requiring customized pin-to-pin wiring configurations and/or customized port connector configurations. Cable jacket color shall be tan.
 - a. Patch cord quantity: Provide one complete patch cord assembly for each outlet port install as part of the Contract and not identified in any other patch cord descriptions. The patch cords shall be customized and configured to comply with the respective Manufacturers recommendations.
 - b. Provide one patch cord for each port-to-port connection length as required for actual installation condition.
 - 1) Provide 100% spare but not less than one spare patch cord for each custom configuration.

- C. Telephone/Voice Copper Wire Portable Patch Cords-110 style
 - 1. 110 style jacks for plugging into the 110 style connecting blocks located in the telephone/voice terminal blocks.
 - 2. Patch cords shall be UTP 4-pair twisted, 24AWG stranded copper individually insulated wires with a thermoplastic jacket over all the wires. Cable shall be ANSI/TIA/EIA-568C.
 - 3. Patch cord quantity and length - telephone/voice terminal block:
 - a. Provide one complete patch cord assembly for each copper wire telephone/voice outlet connecting to the telephone/voice terminal block. Provide additional spare patch cords, quantity equal to 25% of the total quantity of patch cords provided for telephone/voice 110 patch cords.
 - b. Provide the following lengths of copper wire patch cables for telephone/voice 110 style connecting block portable patch cords.
 - 1) 3-feet long - 25% of total
 - 2) 5-feet long - 50% of total
 - 3) 15-feet long - 25% of total
- D. Coaxial Cable Portable Patch Cords
 - 1. BNC type connectors on each end of each patch cord. Shall be compatible with patch panel outlets, workstation outlets and respective equipment rack electronic equipment.
 - 2. Patch cord quantity: Provide two complete patch cord assemblies for each coaxial cable outlet.
 - a. One patch cord for workstation outlet located remote from the equipment rack patch panel, 15-feet long each patch cord.
 - b. One patch cord for equipment rack (IDF/MDF) patch panel each outlet location, 10-feet long each patch cord.
 - c. Provide 15% additional spare patch cords of each patch cord length.
- E. Fiber Optic Portable Patch Cords
 - 1. General
 - a. Provide fiber optic fiber connectors installed on each fiber end of the patch cord cable. The fiber optic portable patch cord shall be "single" with one fiber strand type, for each patch cable. The connector shall be mechanically and optical compatible with the respective connecting patch panel couplers and network work equipment couplers.
 - b. The entire patch cord assembly total insertion loss shall be less than 1.0dB at the specified operating wavelengths.
 - c. Operating temperature range 30-degrees centigrade through +60 degrees centigrade. Cables shall be flame retarding.
 - d. Each fiber shall be individually identified with factory color-coding and factory imprinted label. The outer cable jacket shall be imprinted with date, Manufacturer's model, and catalog number, along with agency listing identification. The cable jacket color shall be yellow.
 - e. All fiber optic patch cord cable shall be a product of the same Manufacturer.
 - f. Optical fiber shall be coated, 900-micron diameter uniform coating, with uniform tight buffering over the coating, uniform dielectric strength member surrounding the buffering coating and an overall jacket around each optical fiber assembly.
 - g. A dielectric strength member shall surround the fiber assemblies.
 - h. An outer dielectric jacket shall envelope the entire cable.

- i. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents.
 - j. Patch cord quantity and length
 - 1) Patch cord quantity: Provide one complete patch cord assembly for each fiber optic patch panel outlet in the equipment rack.
 - 2) Provide one complete patch cord assembly for each computer work station fiber optic outlet remote from the patch panel.
 - 3) Provide additional spare patch cords, quantity equal to 25% of the total quantity of patch cords provided.
 - k. Provide the following quantities and lengths of fiber optic patch cords.
 - 1) 3-feet long - 20% of total
 - 2) 6-feet long - 35% of total
 - 3) 10-feet long - 30% of total
 - 4) 20-feet long - 15% of total
2. Multimode patch cords
- a. Patch cord cable shall be fiber optic cable with equal or better characteristics as the premise fiber optic cables.

2.20 CIRCUIT PROTECTORS

- A. General
 - 1. The circuit protectors shall be UL listed, complying with National Electrical Code, ETL Tested and Certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
- B. Circuit Protectors
 - 1. Cables containing non-dielectric electrical conducting components entering from the exterior of the building shall be provided with individual circuit protectors combining both lightning circuit protection and SPD circuit protection on each circuit conducting component, as required in CEC Articles 770 and 800.
 - 2. Install circuit protectors in the respective backboard/equipment rack where copper wire conductors terminate, connect each protector to room/closet ground bus equipment with #10AWG green insulated bond/ground copper conductors.

PART 3 - EXECUTION

3.01 NETWORK CABLE TESTING AND COMMISSIONING (ADDITIONAL REQUIREMENTS)

- A. General
 - 1. In addition to the testing recommended in ANSI/TIA/ EIA-568C and related Standards, Amendments and TSB. End-to-End test 100% of all individual optical fiber, individual copper wire conductors, each outlet and each connector in all terminated and unterminated cables, portable patch cord, outlets and patch panels provided in the Contract, shall be tested after installation as a complete channel pathway installation, splicing outlets and termination is completed, including the following end-to-end tests on each installed individual circuit;
 - a. Each circuit wire and fiber map and length
 - b. Each circuit insertion Loss

- c. Each circuit NEXT (Pair-to-Pair) Loss
 - d. Each circuit NEXT Loss (Power Sum) PS
 - e. Each circuit ELFEXT Loss (Pair-to-Pair)
 - f. Each circuit ELFEXT Loss (Power Sum) PS
 - g. Each circuit return Loss (RL)
 - h. Each circuit propagation delay
 - i. Each circuit propagation delay-skew
 2. The test equipment and (Tester) shall comply with the Accuracy Requirements for Field Testers as defined in the ANSI/EIA/TIA Standards for the specific cable type. The Tester including the appropriate interface adapter shall meet the specified Accuracy Requirements. The Tester shall be within the calibration period recommended by the Vendor in order to achieve the vendor-specified measurement accuracy. The Tester shall be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The Contractor shall provide proof that the interface has been calibrated within the period recommended by the Vendor.
 3. The Pass or Fail condition for the channel pathway link-under-test is determined by the results of the required individual tests (ANSI/EIA/TIA) Any Fail result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass. A Pass or Fail result for each parameter is determined by comparing the measured values with the ANSI/EIA/TIA test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field test. The Field Test Equipment Manufacturer shall provide documentation as an aid to interpret results marked with asterisks.
 4. Provide all test equipment, Certified Testing Personnel, and setups. Shall comply with ANSI/EIA/TIA and Equipment Manufacturer's recommendations and Standards of Practice.
 5. Provide six copies of all test reports, bound in three ring binders. Provide three digital CD/DVD ROM copies. Organize test reports into rows-and-columns spreadsheet format, with data common groupings by IDF and NDF location. Submit to Owner's Representative.
 6. The Contractor shall repair or replace equipment, cables, outlets, connectors, splices, terminations, etc. identified during testing as not complying with the Contract Documents, without additional cost to the Contract. Retest all replaced or repaired components at Contractor's expense.
- B. Twisted Pair Copper Wire Testing
1. Channel insertion loss (dB).
 2. Channel near-end crosstalk NEXT loss (dB).
 3. Channel equal-level far-end crosstalk ELFEXT (dB).
 4. Channel return loss (dB).
 5. Channel power sum PSACR (dB).
 6. Channel propagation delay, propagation speed, and delay skew.
 7. Channel wire map and circuit length.
 8. Channel ring-out test for continuity and correct point-to-point matching terminals.
 9. Channel DC resistance and capacitance.
 10. Channel attenuation-to-crosstalk ratio ACR.
- C. Coaxial Cable Testing
1. Channel full specified frequency spectrum attenuation insertion loss (dB).

2. Channel wire mapping, ring-out and circuit length.
 3. Channel propagation delay and propagation speed.
 4. Channel impedance and continuity for center conductor and shields.
- D. Fiber Optic Cable Testing, Optical Testing for Each Specified Wavelengths for Both laser and LED sources.
1. Channel link insertion losses (dB) OLTS.
 2. Channel loop-back attenuation (dB).
 3. Channel signature Optical Time Domain Reflectometer – OTDR, for installation characterization testing (event and attenuation resolution dead zone at specified wave lengths, shall be less than 10-feet).
 4. Channel continuity and correct point-to-point matching terminals.
 5. Channel propagation delay and propagation speed.
 6. Channel fiber optic mapping, circuit length, and tracing.

3.02 FIBER OPTIC CABLE TYPE

- A. General
1. Cables shown as fiber optic type shall comply with the following installation locations.
 2. Provide matching compatible outlets and terminate all fiber optic cables into matching fiber optic connectors.
 3. Fiber optic cable installed in indoor locations without enclosed raceway or conduit.
 - a. Provide non-metallic, flexible corrugated continuous inner duct-raceway and install fiber optic cable in the innerduct.
 - b. Innerduct shall be heavy duty, plenum-rated, Limited-Combustible (LC) type UL FHC – 25/50, orange color. Support innerduct 36-inches on center, independent of ceiling supports and independent of other equipment supports.
 - c. Innerduct size shall be selected to ensure percentage-fill with fiber optic cables shall not exceed 30%, but in no case less than 1.25-inch diameter innerduct.
- B. Provide loose tube gel filled or indoor/outdoor type fiber optic cable for any of the following installation location conditions.
1. Inter building (between buildings)
 2. In a conduit or raceway located underground below grade.
 3. In an exposed outdoor conduit or raceway not located underground or below grade.
 4. Do not install loose tube gel filled type fiber optic cable inside a building or exposed on a building without providing Rigid Steel (RGS) conduit raceway for the loose tube gel filled fiber optic cable along the entire length of the cable inside the building or on the building.
- C. Provide tight buffered or indoor/outdoor type fiber optic cable for any of the following installation location conditions.
1. Intra-building (inside a building) where raceway continuously encloses the cable and the raceway is not located underground, below grade.
 2. In an exposed outdoor conduit or raceway not located underground or below grade.

- D. Provide plenum rated type fiber optic cable for any of the following installation location conditions in building spaces.
1. Any building space air plenum (supply or return) when a conduit or enclosing raceway is not provided for the entire cable length. Additionally, Cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
 2. All building space locations where the cable is installed without a conduit or the cable is not fully enclosed in a raceway along the entire cable length in a building. Additionally, Cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
 3. Building spaces and/or cavities that are 100% fully protected with fire sprinklers, including fire sprinklers located above in ceiling cavities and fire sprinklers located below in access floor cavities. Cables installed in these locations shall be rated with one or more of the following additional characteristics.
 - a. Limited-Combustible (LC) UL FHC-25/50 plenum rated cable.
 - b. Or plenum rated cable without the UL FHC-25/50 Limited-Combustible (LC) rating.
- E. Optical Fiber Quantity:
1. The minimum fiber quantities in each fiber optic cable shall be as follows, but in no case less than indicated on the Drawings.
 2. Between main IDF (SUB-MDF) in separate buildings and the MDF main terminal rack fiber optic patch bay for the entire site/campus.
 - a. Twelve-optical fibers, multimode plus eighteen optical fibers, single mode.
 3. Between satellite IDF terminal rack fiber optic patch bays and the main terminal rack IDF (sub-MDF) patch bay located in the same building.
 - a. Twelve optical fibers, multimode plus eighteen optical fibers, single mode.
 4. Between a terminal rack patch bays (IDF or MDF):
 - a. To an individual workstation outlet located inside the same building - two multimode optical fibers, (typical only for locations where fiber is specifically shown on the Drawings for the specific workstation outlet).
 - b. To each network file server outlet location whether or not shown on the Drawings, four optical fiber, and multimode.
 5. Between a terminal rack patch bay and individual multimedia network (television/video/audio) workstation outlets and/or intrusion/access program display devices located inside the same building - two optical fibers, multimode.
 6. Other locations as indicated on the Drawings or described in the Contract Documents.

3.03 COPPER WIRE CABLE TYPE

- A. General
1. Cables shown as copper wire type shall comply with the following installation conditions, unless noted otherwise on the Drawings.
 2. Provide matching compatible outlets and terminate all copper wire cables into matching copper wire connectors.

- B. Cable Types and Quantities - Cable types and quantities shall be as follows unless specifically noted otherwise on the Drawings. The following minimum type and quantity of copper wire cables from each individual workstation/device outlet, to the respective terminal equipment patch panel/bay, (unless specifically noted otherwise), but in no case less than what is shown on the Drawings and in no case less than one 4-pair cable to each outlet "Jack" position:
1. Two Category-6A, UTP 4-pair cables:
 - a. Each network workstation outlet location.
 - b. Each network voice outlet location.
 2. Two Category-6A UTP 4-pair cable, for each "Wireless Access Point" outlet location.
 3. Trunking-Cables shall be Category-5E.
 - a. 100-pair between buildings main IDF (SUB-MDF) and campus main MDF.
 - b. 25-pair inside building between SUB-IDF to buildings main IDF (SUB-MDF).
 8. Other locations as indicated on the Drawings or described in Contract Documents.
- C. Provide plenum rated copper wire cable for any of the following installation location conditions in building spaces.
1. Any air plenum (supply or return) when a conduit or enclosed raceway is not provided for the entire cable length. Additionally, cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
 2. All building space locations where the cable is installed without a conduit or the cable is not fully enclosed in a raceway along the entire cable length in the building. Additionally, cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
 3. Building spaces and/or cavities that are 100% fully protected with fire sprinklers, including fire sprinklers located above in ceiling cavities and fire sprinklers located below in access floor cavities. Cables installed in these locations shall be rated with one or more of the following additional characteristics.
 - a. Limited-Combustible (LC) UL FHC-25/50 plenum rated cable.
 - b. Or plenum rated cable without the UL FHC-25/50 Limited-Combustible (LC) rating.
- D. OSP Insulated Copper Wire Cables
1. Outside – Plant (OSP) CEC/NEC rated, UL listed, labeled, and approved insulated copper wire cable assemblies. Moisture barrier resistant and UV resistant cable jacket. Non-flammable, water blocking, non-conductive gel internally filled infrastructure cable assembly.
 2. Provide rated insulated copper wire OSP type cable for any of the following copper wire infrastructure cable install locations.
 - a. In underground conduit or in conduit under the building.
 - b. In conduit exterior to the building, or in conduit exposed outdoor on the building.
 - c. Outdoor aerial with aerial messenger wire cable carrier.
 3. Except for aerial install locations, install all OSP cable in continuous conduit pathways, end-to-end.

3.04 CABLE INSTALLATION

A. General

1. Cables connecting to equipment racks and terminal blocks shall be installed with not less than 6-feet of slack cable between the equipment rack/terminal block and terminal back-board. The slack cable shall be coiled and supported on the backboard and/or cable tray.
2. Cables in terminal closets and terminal rooms shall be trained, dressed, and racked on the plywood backboards. Provide cable, metal support arms and re-entrant type cable support rings not less than 12-inches on center mounted onto the plywood along the entire length of all cables.
3. Provide separate routing paths on plywood backboards for fiber optic cables, computer data and copper wire cables and telephone/voice copper wire cables and multimedia, audio/video, TV cables. Provide separate routing paths on plywood backboards for shielded copper wire cables and unshielded copper wire cables.
4. Cables shall be routed parallel to floors and walls. Do not route cables diagonally on backboards.
5. Spare cable slack
 - a. Provide 25-feet of cable slack where unterminated cables are specified at terminal backboards.
 - b. Provide a minimum of 18-inches of slack cable in each workstation outlet box and outlet locations.
 - c. Provide 10-feet of cable slack in ceiling above each workstation outlet.
 - d. Provide 24-inches of slack in each cable at patch panel locations.
 - e. Coil and "Velcro" wrap slack cable.
6. Provide "horizontal wiring" cables installed from individual equipment locations and workstation outlets to respective MDF/IDF terminal closet/room patch panel. Cables shall be continuous without cutting or splices.
7. Provide "backbone" cables installed from each IDF location to respective MDF/ Sub-MDF location terminal closet/room patch panels. Cables shall be continuous without cutting or splices.

B. Cable Pulling Lubrication

1. Cable pulling lubricants shall be specifically approved by the Cable Manufacturer. The following lubricants shall be used where approved by the Cable Manufacturer.
 - a. Slip X -300, American Colloid Co.
 - b. Bishop #45, Bishop Electric.
 - c. MacLube CA51, MacProducts.
 - d. Minerallac H2B, - Minerallac Electric.
 - e. Winter grade #7437-PC, General Machine Products.
 - f. Gel-lube 7/5, Cable associates.
 - g. Polywater, A, C, G - American Polywater.
2. Lubricants shall be continuously applied as cable enters raceway.

C. Cable Installation:

1. Do not pull conductors until factory test reports have been submitted and reviewed.

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2. Minimum bending radius of fiber optic cables shall not be less than the following. Maximum pulling tension shall not exceed the following. In no case shall the Manufacturer's recommendations be violated.

<u>Cable Type</u>	<u>Cable Fiber Quantity</u>	<u>Minimum Bend Radius</u>	<u>Maximum Pulling Tension</u>
Loose Tube	2-84	9 inches	600 pounds
Loose Tube	86-192	10 inches	600 pounds
Tight Buffered	2-12	5 inches	400 pounds
Tight Buffered	14-24	7 inches	600 pounds
Tight Buffered	26-28	11 inches	1100 pounds
Tight Buffered	48-72	12 inches	1200 pounds

3. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate Manufacturer's recommendations.
4. Cables installed in manholes and pullboxes on terminal backboards shall be installed on wall mounted cable support racks.
5. Provide a full 360-degree loop of cable around manhole and pullbox interiors.
6. The attachment of pulling devices directly to the cables shall be with individual split mesh basket grips. Direct connection for pulling cables to cable fibers and copper wires shall not occur. Securely tape cable ends to prevent moisture or pulling compound from penetrating cable.
7. The attachment of the pulling device to the cable basket grips shall be made through a swivel connector.
8. The Contractor shall ensure that the cables are fed straight into the raceway taking care to avoid short bends, sharp edges, and cable "cross-overs".
9. All lashings used for temporary bunching of the individual cables shall be removed before the cables enter the raceway.
10. Cables shall be "pulled through" or pulled from a "center of run pull" without splices or terminations and minimize cable rolling tension. Lead-out the cables at all manholes, pullboxes and conduits taking care to feed them in again by hand for the next portion of the cable run.
11. For each cable pull where a cable direction change is required, flexible feed-in tubes, pullout devices, multi-segmented sheaves etc. shall be used to ensure proper cable pulling tensions and side wall pressures. Cables shall not be pulled directly around a short right-angle bend. Any device or surface the cable comes in contact with when under pull-in tension shall have a minimum radius 50% greater than the final specified minimum installed cable bending radius. The maximum possible size radius sheaves and feed-in tubes, usable in the available working space, shall be provided in all situations, to insure the minimum possible cable sidewall pulling pressure. Do not use devices with multi-segment "roller" type sheaves.
12. Cable lengths over 50 feet shall be machine pulled not hand pulled into and through all raceways. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.
13. Cables shall be pulled straight into or out of the raceway without bends at the raceway entrance or exit. Pull in cable from the end having the sharpest bend (i.e., bend shall be closest to reel). Keep pulling tension to minimum by liberal use of lubricant, hand turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one at manhole or pull-hole during this operation. Cables shall be pulled directly from cable reels.

14. Cables shall be trained or racked in trenches, vaults, manholes and pull boxes with consideration given for the minimum specified bending radius of the cable and the possibility of cable movements due to load cycling. The cables shall be racked and supported in such a manner that adequate space is allowed for splicing and the cables shall always be fanned out from the duct or conduit so as not to cross other ducts, conduits or cables. To prevent damage from falling objects or Personnel entering the manhole the cables shall not pass directly under the manhole opening.
15. Cable shall be supported in manholes, pull boxes and vaults a minimum of 18-inch on center with cable racks. Provide hot dip galvanized, T-slot racks and support arms. Secure cables to racks with porcelain supports for each cable on the racks. Loosely lash cables to racks. Splices shall be directly supported, on racks. Do not install cables more than one feeder on the same rack hook.
16. Cables shall be routed the long way around manhole, pull-hole, etc. with not less than a full 360-degree loop around the perimeter walls unless noted otherwise.
17. Existing conductors shall be protected at all times when Contract work occurs in the same area, including but not limited to pullboxes, vaults manholes, cable trenches etc. Provide temporary electrical insulating blankets and barriers over existing conductors to reduce the possibility of accidental mechanical damage to existing conductors.
18. Where cable tray is provided, all cables shall be routed and trained on the cable tray. The cables shall enter the cable tray and route along the tray prior to entering any equipment racks or computer works station outlets.
19. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200-feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull.
20. Bends shall not be made in cable splices or terminations.
21. The portions of cables installed without raceways or cable tray supports shall be installed with metal "J-hook" cable supports.
 - a. The "J-hooks" shall provide multi-tiered "J" shaped hooks, with wide flat cable support base (0.5-inch-wide minimum) and smooth rounded corners. Specifically designed for copper wire and fiber optic infrastructure cable support as manufactured by Erico Inc.
 - b. The individual "J-hook" attachment to the building structure shall be metal, "beam clamp", "hanger rod", clevis hanger styles as applicable for each attachment location.
 - c. Install "J-hooks" not more than 48-inches on center along the entire cable length and within 6 inches of each cable change in direction. Locations of "J-Hooks" and tension of cables shall insure between 4-inches and 6-inches of cable sag between adjacent hooks. Secure cables to "J-hooks" with re-enterable cable tie wraps. "J-hook" supported cables, bundle cables together with re-enterable tie wraps not less than 12 inches on center along the entire cable length.
 - d. Each J-hook shall not support more than 12 individual cables. Provide multiple "tiered" J-hooks for additional cable quantities at each location.
 - e. "Bridle rings" shall NOT be used to support cables.
 - f. Cables shall not lie directly on nor attach to ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.
22. Re-enterable cable tie wraps shall be, "limited-combustible" and air plenum rated, reusable, color coded. Chemically and mechanically compatible with the respective cables and install locations. Shall allow multiple open-close operations for securing cables.

23. Electronic network cables containing non-dielectric components shall be installed with a minimum separation from other electrical power conductors and equipment as follows:

<u>Equipment Type</u>	<u>Minimum Separation</u>
a. Lighting fixtures	12 inches
b. Electric motors, electric solenoids, electric Heaters	40 inches
c. Transformers	48 inches
d. Circuits over 100 volts to ground, in metallic raceways	5 inches
e. Circuits over 100 volts to ground, in non-metallic raceway or without any raceway	12 inches
f. Circuits over 100 volts to ground, suspended on overhead pole lines	48 inches

D. Movement, Storage, and Handling of Cable:

1. Reels of cable shall not be dropped from any height, from trucks or other transporting equipment.
2. Lift and move cable reels using following methods:
 - a. Crane or boom type equipment-insert shaft (heavy rod or pipe) through reel hubs and lift with slings on shaft, with spreader or yoke to reduce or avoid sling pressure against reel head.
 - b. Forklift type of equipment may be used to move smaller, narrower width reels. Fork tines should be placed so that lift pressure is on reel heads, not on cable, and shall reach all the way across reels so lift is against both reel heads.
 - c. Reels may be moved short distances by rolling. Reels shall be rolled in the direction indicated by arrows painted on reel heads. Surfaces over which the reels are to be rolled shall be solid clear of debris, and also clear of protruding stones, humps, etc. which might damage the cable if the reel straddles them.
3. Storage of reels of cable:
 - a. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2-inches down to insulation. Then apply four layers of an insulating tape crisscross over the cable end and carry back at least 4-inches onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.
 - b. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Additional covering such as tarpaulin, plastic sheeting, etc. shall be used if cable is to be stored outdoors.
 - c. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.
 - d. Use fencing or other barriers to protect cables and reels against damage by vehicles or other equipment moving about in the storage area.

3.05 CABLE SPLICES

A. General

1. Splice(s) in cables shall occur only in the following locations:
 - a. Pullboxes or manholes.
 - b. Terminal backboard, closets, or rooms.
 - c. Equipment racks.

- d. Wall mounted interface cabinet.
 - e. Do not splice cables in conduit, cable tray, raceways, or plenums.
 2. Polarity and color-coding shall be maintained consistent through splices, terminations, and outlets for the entire electronic network system.
 3. Cable splices in outdoor areas, manholes, pullholes shall be watertight, inside universal splice enclosures.
- B. Fiber optic cable splices unless specifically indicated otherwise below, fiber optic cable splices between fiber optic cables fibers shall be fusion type splices.
1. Splices between loose tube gel filled fiber optic cable fibers shall be fusion type splices.
 2. Splices between indoor/outdoor fiber optic cable fibers shall be fusion type.
 3. "Pigtail" splices of tight buffered and indoor/outdoor fiber optic cable fibers to loose tube gel filled cables shall be fusion type splice.
 4. Splices between tight buffered fiber optic cable fibers to indoor/outdoor fiber optic cables shall be fusion type splice or mechanical type splice.
 5. Splices between tight buffered fiber optic cable fibers shall be mechanical type splice or fusion type splice.
 6. "Pigtail" splices of tight buffered fiber optic cable fibers to tight buffered fiber optic cable fibers shall be mechanical type splice or fusion type splice.
 7. Fiber optic splices shall be performed to maintain the data transmission rates specified for the entire respective system.
- C. Copper Wire Splice
1. Copper wire extending from infrastructure workstation outlets to respective equipment rack patch panel outlets shall not be cut or broken and shall be continuous end to end.
 2. Copper wire extending from telephone/voice workstation outlets to respective terminal blocks shall not be cut or broken and shall be continuous end to end.
 3. Continuity of cable shields (where occurs), polarity and color coding shall be maintained across all splices.
 4. Copper wire splices shall be performed to maintain the data transmission rates specified for the entire respective system.

3.06 CABLE TERMINATIONS

- A. General
1. Infrastructure workstation outlets connecting to ports in patch panels and terminal blocks shall be grouped together in the patch panel and terminal block by outlet function, room location and building area location (i.e. Group #1 Room #120 1st floor; Group #2 Room #200 east wing, etc.). Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.
 2. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.
 3. Terminate all cables onto respective outlets connectors, interconnection couplers and terminals. Terminations shall comply with Manufacturer's recommendations, ANSI/TIA/ EIA-568C related Standards, Amendments and TSB.
 4. Fiber optic cable fiber strands and copper wire cable conductors terminated at outlet locations shall be connected with a strain relief device attached to the

cable jacket to prevent cable tension from being transmitted to the termination connectors.

5. Cable terminations shall be performed to maintain the data transmission rates specified for respective entire system.

B. Fiber Optic Terminations

1. Individual fiber optic fibers shall each be terminated with a fiber optic fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber inter-connection couplers on the rear of each respective outlet.
2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to ensure fiber "undercut", "protruding" fiber, over polish and under polish of fiber termination ends does not exist in the finished termination ferrule.
3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together (Duplex-Pair) for purposes of identification and connection transmit/receive pair. Each pair of connectors for fibers shall be "plugged" into separate, physically adjacent fiber optic fiber duplex-pair inter-connection couplers at each patch panel. The horizontal/vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.
4. Fiber optic cable fiber strands terminated at patch panels shall be installed with a minimum of 540 degrees of each fiber strand looped around the splice tray individual fiber "training" rings.
5. Fiber optic cable connecting from infrastructure workstation outlet to a fiber optic patch panel.
 - a. The connectors for fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers.
 - b. The patch panel coupler shall be color coded to identify the polarity of the trans-mitting and receiving optical fibers.
6. Fiber optic cable connections at workstation outlets.
 - a. The connectors for fibers shall be "plugged" into separate physically adjacent fiber optic fiber interconnection couplers in the outlet.

C. Copper Wire Terminations

1. Where occurs, the shield on metal shielded copper wire shall be terminated and connected to the shield grounding connection at each termination point.
2. Twisted wire pairs shall not be untwisted for a length of more than 0.4-inch at any location and the cable jacket shall not be striped back not more than 0.5 inch any location including splices and terminations.
3. Unless specifically directed otherwise by the Owner's Representative, Pin assignment for wiring terminations shall comply with ANSI/TIA/EIA-568C type T568A or Type T568B as required for compatibility with the electronic network equipment. The termination type shall be consistent throughout the project Contract area.
4. Copper wire terminations shall be performed to maintain the transmission rates specified for the respective entire system.

3.07 EQUIPMENT RACKS

A. General

1. Install, assemble, mount, and connect devices and equipment in the respective equipment racks, bolted securely to the rack frame with stainless steel hard-

- ware. "Star" style lock washers shall be provided to insure an electrically continuous ground path between the equipment/devices and rack frames.
2. Provide blank metal filler panels to close unused equipment "front" mounting space in equipment racks, Manufacturer's standard finish color.
 3. Provide a copper wire outlet connector in the respective equipment rack for each remote copper wire infrastructure workstation outlet and copper wire cable shown connected to the respective equipment rack, plus the spare copper wire outlet connectors required in the Contract Documents. The copper wire outlet connectors in the equipment racks shall be provided in equipment rack mounted copper wire patch panels. In no case shall the quantity of equipment rack mounted copper wire outlet connectors be less than the quantity of cables indicated on the Drawings, plus required spaces/spares.
 4. Provide fiber optic fiber connectors and fiber optic fiber interconnection couplers in the respective equipment rack for each remote fiber optic infrastructure workstation outlet, and fiber optics cable fiber shown connected to the respective equipment rack, plus the spare fiber optic fiber connectors required in the Contract Documents. The fiber optic fiber connectors and fiber optic fiber interconnection couplers in the equipment racks shall be provided in equipment rack mounted fiber optic fiber distribution enclosures (RTDE). In no case shall the quantity of equipment rack mounted fiber optic fiber connectors and fiber optic fiber interconnection couplers be less than the quantity of cables indicated on the Drawings, plus required spaces/spares.
 5. Fiber optics cable fibers specifically shown as non-terminated "splicing-thru" in the equipment rack shall route through fiber optic splice only enclosures (RMSE), mounted in the respective equipment rack.
 6. The maximum quantity of cable terminations, in each equipment rack mounted patch panels shall not exceed the following. To insure not less than 50% of the rack space remains available for equipment installation:
 - a. 100% copper wire outlet connectors, 196 maximum per rack.
 - b. 100% fiber optic fiber terminations, 144 maximum per rack.
 - c. Combination of copper wire outlet connectors and fiber optic fiber terminations in the same rack; 48 maximum fiber optic fibers plus 144 maximum copper wire outlet connectors per rack. 18 maximum fibers plus 48 maximum copper wire in 30 inches high.
 - d. In addition to the quantity of patch panel outlets for termination of incoming and outgoing cables, provide not less than an additional 15% of patch panel spare outlets of each type, in each equipment rack for future use.
 7. Provide additional equipment racks, quantity of racks to ensure the maximum specified quantity of terminations in single rack are not exceeded and the quantity of cable terminations complies with the Requirements of the Contract Documents.
 8. Terminal racks, equipment locations, patch panels, and cross connects shall be arranged to allow for natural cabling progression, minimize crossing of cables and allow easy access to each system component.
 9. Equipment Rack Anchorage:
 - a. Equipment racks installed on raised "access floor" systems, shall be supported and anchored with bolts that extend into the "structural" floor located below the "access floor".
 - b. Securely anchor the support arms of swing gate racks to the wall structural support system.
 - c. Securely anchor fixed support base of the racks to the floor.

- d. Mounting method shall support the total rack weight including installed equipment, but in no case less than 500 pounds with a 2.0 times safety factor.
 - e. Attachments and anchorages shall comply with the Requirements for earthquake seismic rating at the install location.
 - 10. Unless specifically noted, otherwise provide the following equipment rack types:
 - a. Floor standing equipment racks containing patch panel locations, computer/data network HUBS/switches and computer data network concentrators, shall be Swing Gate style equipment racks.
 - b. Floor standing equipment racks containing multimedia, audio/video, TV head end equipment, shall be Metal Enclosed equipment racks.
 - c. Wall mounted external to dedicated IDF/MDF terminal rooms/closets (i.e. inside individual classrooms), shall be Mini-Equipment racks.
 - 11. Install ground bus, PDU/SPD, cable management rings, equipment, patch panel and patch panel outlets, etc. in equipment racks.
 - 12. Equipment rack terminology:
 - a. The location containing the main campus equipment rack location shall be identified as the Main Distribution Frame – (MDF).
 - b. The locations remote from the MDF containing satellite equipment racks shall be identified as Intermediate Distribution Frames (IDF).
 - c. A individual building located on a multi-building campus site with multiple equipment rack locations in the building, the building main rack location shall be identified as Sub-MDF (or building MDF) and the remaining equipment rack locations in the building shall be identified as IDF.
- B. Floor Standing Equipment Racks
 - 1. General:
 - a. Securely anchor racks to floor.
 - b. All incoming cables shall enter through the top or bottom of the racks.
 - c. The front of the racks shall maintain a minimum of 42-inches of clear working space.
 - d. Multiple floor standing racks shall be installed directly adjacent to each other (i.e. side by side), with not less than 6-inches (edge-to-edge) space between adjacent racks.
 - e. Cables entering racks shall enter into the top of the rack from overhead cable tray, or from wall along wall support arms to rack.
 - 2. Floor standing metal enclosed equipment racks:
 - a. The rear of the rack shall maintain a minimum of 36 inches clear working space.
 - b. Provide a minimum spacing between adjacent (edge-to-edge) racks of not less than 6-inches.
 - 3. Floor standing open (non-swing gate) equipment racks.
 - a. The rear of the rack shall maintain a minimum of 54-inches clear working space behind the rack frame rails for adequate installation depth of HUBS / switches equipment, for "walk" behind access to equipment and for cable terminations access.
 - b. Provide a minimum spacing between (edge-to-edge) racks of not less than 6-inches.
 - 4. Floor standing modular frame equipment racks:
 - a. The rear of the racks shall abut against the wall, or as shown on the Drawing.

3.08 TELEPHONE/VOICE TERMINAL BLOCKS

- A. The telephone/voice terminal blocks shall be assembled in vertical sections, for wall mounting. Install adjacent vertical sections with not less than 8-inch blank space between sections, for cable training space.
- B. Install terminal blocks on plywood terminal backboard with #8 x 1-inch wood screws. Minimum 6-inches on center, along each side of each terminal block.
- C. Terminal block wire pair capacity:
 - 1. The minimum wire termination capacity shall not be less than 600 pairs of telephone/voice conductors, at any telephone/voice terminal block.
 - 2. The quantity of wire pair terminations provided at each terminal block shall be based on the following formula. However, under no case shall any terminal block wire pair capacity be less than the specified minimum.
Total quantity of telephone/voice feeder copper wire pairs connected to the terminal board = QFP
Total quantity of telephone/voice outlets connected to terminal board - QTO
 $(QFP) \times (QTO \times 4) + (\text{specified spares}) = \text{Minimum terminal block pair capacity.}$

3.09 MDF AND IDF CIRCUIT TERMINAL ROOMS AND CLOSETS

- A. Terminal Backboard
 - 1. A $\frac{3}{4}$ -inch thick marine "A-C" grade plywood backboard shall fully cover each wall of terminal closets and terminal rooms, including all MDF and IDF rooms/closets. Provide backboard on the wall for equipment racks, incoming cable raceways and terminal blocks. Plywood shall extend continuous from the finish floor to 8-feet above the finish floor on all walls. "A" side of plywood shall be exposed.
 - 2. Attach plywood to wall structural framing with mechanical fasteners a minimum 6-inches on center vertically on walls at each framing vertical member, and along the length of the wall, but not less than 16 inches on center horizontally along the length of the wall.
 - 3. Paint plywood terminal backboards after installation and prior to mounting any equipment. One coat of wood paint fire resistant primer and two coats of fire resistant/intumescent, non-conductive finish coats of paint. Finish color matt/flat white, acrylic enamel fire resistant/retardant latex paint.
- B. Cable Tray
 - 1. Locations with equipment racks, and/or terminal blocks are installed in the same room/closet (MDF or IDF).
 - a. Provide a horizontal cable tray above the equipment racks and terminal blocks in each circuit terminal room and closet.
 - b. Provide a horizontal cable tray continuous "loop" around the perimeter inside each MDF and IDF room, within 12-inches of the ceiling. Parallel with and adjacent to all walls in the room.
 - 2. Ladder type cable tray 18 inches wide by 6 inches deep; length-end wall to end wall, of the closet or room.
 - 3. Install the cable tray centered above all equipment racks, and around the room perimeter at ceiling/walls [and terminal blocks] with ceiling and wall suspension system. Install trays not more than 36-inches above and not less than 12-inches above the top of the equipment racks.

4. Where multiple segments of cable trays occur in terminal closets and rooms, provide interconnecting cable trays between each segment located in the respective room/closet.
- C. Conductor Training and Support
1. Provide conductor/cable training and racking support distribution rings installed on backboards. As manufactured by Newton 3042 Series, Saunders or equal.
 2. Support rings shall be spaced a minimum of 10-inches on center along all cable/conductor routing paths on backboards and within 4-inches of each change in cable/conductor direction.
 3. The capacity of support rings shall be equal to the weight and quantity of conductors/cables passing through the respective support ring plus 100% spare capacity for installation future conductors/cables. In no case shall support rings be smaller than 3 inches.
 4. Attach support rings to backboards with not less than two $\frac{3}{8}$ -inch diameter by $1\frac{1}{8}$ -inch long threaded wood anchor bolts for each individual bracket.
- D. Environment Space Monitoring (MDF and IDF)
1. In each room/closet provide one automatic environmental monitor. Self-calibrating, simultaneous monitoring, and software programmable, with alarm set points. Shall measure and monitor ambient conditions and provide data-logging for conditions in the space for the following:
 - a. One ambient temperature port and plug-in indoor sensor.
 - b. One ambient humidity port and plug-in indoor sensor.
 - c. One spare plug-in port for an external digital sensor.
 2. Digital Fast Ethernet LAN RJ-45 communications port, with alarm alerting and communications software for remote monitoring of the ambient conditions via the LAN. Multi-user site wide software license, compatible with PC-computer and IP-WEB HTTP remote operations.
 3. Local internal audio and visual alert annunciators, with local silence and reset.
 4. 120 volt, 60Hz AC input power supply operation. Equipment rack mount self-contained unit housing configuration. Provide all interconnect cabling and connectors.
 5. Provide the environmental unit in one of the equipment racks located in each of the respective spaces.
 6. As manufactured by Avtech-Room Alert; or SensaTronic-Environmental Systems; or IT Watch Dog-Climate Monitors.

3.10 GROUND (ADDITIONAL REQUIREMENTS)

- A. Electronic Equipment MDF, IDF and Terminal Rooms and Closets
1. Terminal Equipment Ground Bus (TEGB) - Provide a wall mounted TEGB ground bus in each MDF location. Also provide a TEGB where two or more equipment racks and/or terminal blocks are provided in each IDF. The TEGB ground bus shall be copper $\frac{1}{4}$ -inch by 2-inches (nominal) by 12-inches long (minimum). Install the TEGB on the wall with a minimum of two "stand-off" electrical insulators. Drill and tap the ground bus and provide bolted type ground lugs for connection of each ground conductors size #10AWG - #1AWG. Provide spare unused ground lugs on the TEGB.
 2. Provide 1.25-inch conduit with 1#1AWG copper insulated ground conductor from the TEGB homerun to the building main ground reference bus. Provide 1.25-inch conduit with 1#1AWG copper insulated ground conductor from the

TEGB homerun to the nearest building main structural steel member and to the nearest metal cold water pipe larger than 0.6-inch diameter pipe.

- a. Provide the same ground connections from the equipment rack ground bus where only a single equipment rack occurs in the IDF location.
3. The ground conductor required from the TEGB to the building main ground reference bus may be looped and connected between separate TEGB ground bus locations if all of the following conditions are met.
 - a. The ground conductor is increased to 1.5-inch conduit with 1#2/0AWG copper insulated and the total end to end length does not exceed 300-feet.
 - b. The building exceeds two floors in height.
 - c. Not more than four TEGB buses are connected to the same "looped" ground conductor.
 - d. The TEGB ground conductor is continuous (not cut, spliced, or broken) along its entire length.
 - e. The TEGB ground conductor is connected to the TEGB ground buses with a UL listed "Exothermic" welding process.
- B. Equipment Racks:
 1. Provide a separate 12AWG copper stranded green insulated ground conductor from each individual equipment element in the rack to the respective rack ground bus.
 2. Provide a separate #8AWG copper insulated ground conductor from each equipment rack ground bus to the TEGB terminal equipment ground bus located in the same space.
 3. Where only one equipment rack is installed, provide 1.25-inch conduit with 1#1AWG copper insulated ground homerun conductor from the equipment rack ground bus homerun to the building main ground reference bus and provide 1.25-inch conduit with 1#1AWG copper insulated ground conductor from the TEGB or single equipment rack ground bus (as applicable), to the nearest building main structural steel member and to the nearest metal cold water pipe larger than 0.6-inch diameter pipe.
 4. Provide 1.25-inch conduit with 1#4AWG copper insulated ground conductor from each wall mounted fiber interface cabinet to the respective TEGB ground buses.
 5. Provide a 1#10AWG copper insulated ground conductor connecting in a continuous loop to all miscellaneous cable trays and metal support equipment located in the terminal closet or room and connect to the TEGB ground bus.
- C. Telephone/Voice Terminal Blocks:
 1. Provide a separate #8 copper insulated ground conductor from each terminal block section ground bus to the TEGB terminal equipment ground bus.
 2. Provide a separate #6 copper insulated ground conductor from the terminal room/closet to the lightning ground system.

3.11 WALL MOUNTED FIBER INTERFACE CABINET - WMIC

3.12 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

- A. General
 1. Fiber optic and copper wire cables shall be identified in each manhole, pull box, equipment rack, patch panel and computer workstation outlets.

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2. Infrastructure documentation, identification labels and color coding shall comply with ANSI/TIA/EIA-606A Administration Standard for Telecommunications Infrastructures, Class-1 thru Class-4. Provide management software MS-Windows-based single user license, with all as-built data entry documentation information complete.
- B. Identification tags shall include the following information:
1. Cable name as indicated on Drawings (i.e., HV1, F4, MSB3 etc.).
 2. Installation month and date (i.e., 3/92, 4/78 etc.).
 3. Conductor size conductor type (i.e., loose tube fiber; #24AWG ScTP Category 5, 200-pair, telephone/voice etc.).
 4. Feeder taps to equipment or building shall also be identified with equipment name or building (i.e. library, SW1, Rack #21, etc.)
- C. Identification Tags
1. Tags shall be 1/8-inch thick 98% lead, approximately 2-inch square with chamfered corners. Two holes shall be drilled for attachment to primary cable. Lettering shall be 1/8-inch high, engraved or die stamped. Attach tags to primary cables with two #14AWG (THWN insulated) solid copper conductors "twist-tied", with insulated CAP wire-nut on the tie-wire ends, to cover sharp edges of tie-wire conductor.
 2. Alternate identification tags, at the Contractors' option in lieu of lead tags. Provide polypropylene tag holders with interchangeable, yellow polypropylene tag with black alphanumeric characters sets. Characters shall be approximately .25-inch high. As manufactured by Almetek industries "EZTAG" - Ledgewood, New Jersey.
- D. Equipment and outlet naming identification and color-coding shall comply with ANSI/EIA/TIA latest revision.
1. Naming method for equipment, outlets, and cables; where a position in the naming string is unused, provide multiple "*****" symbols.
Typical naming string "ADM-02-1141-PP17-1271"
 - a. "ADM" - Abbreviated Building Name or Number (i.e., Administration, B127, etc.)
 - b. "02" - Floor Level #2 or as applicable.
 - c. "1141" - Outlet, Equipment or Terminal Room/Closet name or room number as applicable.
 - d. "PP17" - Terminal Rack Patch Panel Identification.
 - e. "1271" - Individual Outlet or Port Identification.
 2. Connecting hardware color coding shall be as follows:
"Green" - Main central terminal location for entire site.
"White" - Distributed terminal locations other than the main terminal.
"Blue" - Horizontal wiring hardware systems for workstations.
- E. Provide warning nameplates on fiber optic patch panels, fiber optic outlets, and any location where fiber optic cables are terminated. Minimum 1/8-inch high engraved/etched letters. "WARNING - LASER LIGHT SOURCE. DO NOT LOOK DIRECTLY AT OUTLET OR FIBER CABLE ENDS. RISK OF SEVERE EYE DAMAGE OR BLINDNESS".

END OF SECTION 27 2000

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SECTION 27 4110

AUTONOMOUS SOUND REINFORCEMENT SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. All applicable portions of Section 26 0000 shall apply to this Section as though written herein completely.
- B. The work under this Section includes all labor, materials, equipment, and accessories required to furnish and install a complete Integrated Intercom/Life Safety/Sound Reinforcement Systems as indicated on the Drawings and as specified herein.

1.02 RELATED WORK:

Document affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections of Divisions 1 and 26 of these Specifications.

- A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.
- B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets and back-boards are furnished and installed by others and not part of this Section. The wiring, cables, equipment, devices, etc., shall be furnished and installed complete under this Section. Conduit and junction box sizes shall be determined by the Installing Communications Contractor for the particular wire and cable fills required for the systems installed (conduit sizes shall comply with the National Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for 1-year after final acceptance under this Section shall be the responsibility of the Communications Contractor.
- C. The Installing Communications Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all Specified Requirements.

1.03 INSTALLER QUALIFICATIONS

- A. The Installing Contractor shall hold a valid State of California C-10 License, shall have completed at least twenty Projects of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least 5-years, and capable of being bonded to assure the Owner of performance and satisfactory service during the guarantee period.
- B. The Installing Contractor shall hold all other licenses required by the legally constituted Authorities Having Jurisdiction over the work.
- C. The Installing Contractor shall be a Factory Authorized Distributor and warrantee station for the brand of equipment specified and shall maintain a fully equipped

service organization capable of furnishing adequate repair service to the equipment. The Installing Communication Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at Contractor's Shop.

- D. The system as specified herein is available from Quantum Sales and Technology in Santa Ana, California. Contact Mr. David Brown at 714-595-0863.

1.04 QUALITY ASSURANCE:

- A. All Mechanical, Electrical and General information set forth on the respective data sheets for each specified item shall be considered to be part of these Specifications and binding herein. Any proposed equal item offered shall be substantiated fully to prove equality. The Architect reserves the right to require a complete sample of any proposed equal item and may, if necessary, request a sample tested by an independent Testing Laboratory to prove equality. The decision of the Architect regarding equality of proposed equal items will be final.
- B. It is the intent of these Specifications to establish a standard of quality for labor and material to be installed. The Base Bid shall include materials as specified without exception. For any proposed substitution, complete descriptive, technical and cost comparison data and test reports shall be submitted for review during the bidding period. The Contractor shall reimburse the Architect for any additional engineering charges and shall pay all charges of other trades resulting from substitutions. Proposed substitutions shall be listed on the bid form, stating the reasons for substitution and the amount to be deducted from the bid if the substitution is allowed. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system and installation of the specified system at the Contractor's expense.
- C. If a substitution item is given final acceptance by the Owner, the Contractor shall pay all costs (including travel, lodging, meals, computers, etc....) required to provide factory certification, equal to that of a Factory Authorized Distributor of the substituted item, for two selected Owners Representatives. This training shall occur at the primary factory of the substituted item in question and shall allow the selected Owners Representatives to provide any and all Factory / Manufacturer approved repairs, services, software upgrades, etc., without affecting any available or applicable Manufacturer Warranties.
- D. All of the Electronic Systems Equipment shall be furnished and installed by the authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the Manufacturer of all major equipment, which certifies that the Installing Communication Contractor is the authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the Manufacturer that they will have a service representative assigned to this area for the life of the equipment.
- E. Supplied system shall fully comply with the current California Education Code 17077.10, which states, that any telephone installed within an Educational Environment whether restricted or not, shall have direct access to the Emergency Services Operator (911). In addition, when a telephone dials 911, the front office will be notified of which extension placed the call. Access codes are not acceptable. Simply dialing 911 from any telephone will reach the Emergency Services Operator.

Any systems requiring access codes are not acceptable since State Funding would be withheld until compliance is met.

- F. Electrical Component Standard: Provide work complying with applicable Requirements of NFPA 70 "National Electrical Code" including, but not limited to:
 - 1. Article 250, Grounding.
 - 2. Article 300, Part A. Wiring Method.
 - 3. Article 310, Conductors for General Wiring.
 - 4. Article 725, Remote Control, Signaling Circuits.
 - 5. Article 800, Communication Systems.
- G. EIA Compliance: Comply with the following Electronics Industries Association Standards:
 - 1. Sound Systems, EIA-160.
 - 2. Loudspeakers, Dynamic Magnetic Structures and Impedance, EIA-299-A.
 - 3. Racks, Panels, and Associated Equipment, EIA-310-A.
 - 4. Amplifiers for Sound Equipment, SE-101-A.
 - 5. Speakers for Sound Equipment, SE-103.
- H. Installation and startup of all systems shall be under the direct supervision of a local Agency regularly engaged in installation, repair, and maintenance of such systems. The Supplier shall be accredited by the proposed Equipment Manufacturers and be prepared to offer a Service Contract for system
- I. The Material in this Section will be covered by the Rauland Factory 5-year material warranty policy.

1.05 SUBMITTAL AND MANUALS

- A. Comply with all Requirements of the General Conditions, Supplementary Conditions, and applicable Sections of Divisions 1 and 26 of these Specifications.
- B. Additional Requirements of this Section are:
 - 1. Within 35-calendar days after the date of award of the Contract, the Contractor shall submit to the Architect for review, eight copies of a complete submission.
 - 2. The submission shall consist of Five Major Sections with each Section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.
 - a. The First Section shall be the "Index" which shall include the project title and address, name of the firm submitting the proposal and name of the Architect.
 - b. The Second Section shall include a copy of the Installing Communication Contractors valid C-10 California State Contractors License, letters of factory authorization and guaranteed service, list of 20-projects of equal scope and list of proposed instrumentation to be used by the Contractor.
 - c. The Third Section shall contain the Comparative Specification listing, including a complete listing of the characteristics of the equipment to be furnished next to all of the specified equipment's features and functions as stated in the Specifications and data sheets.
 - d. The Fourth Section shall contain an original factory data sheet for every piece of equipment in the Specifications.
 - e. The Fifth Section shall contain a wiring designation schedule for each circuit leaving each piece of equipment and complete Plan Drawings showing system wiring.

- C. The Contractor shall provide two copies of an "Operating and Servicing Manual" for the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following: Instructions necessary for the proper operation and servicing of the system; complete As-Built Installation Drawings of the system; a wiring destination schedule for each circuit leaving for each piece of equipment; a schematic diagram of major components with all transistor and IC complements and replacement number.

PART 2 – PRODUCTS

2.01 SYSTEM

- A. The system shall provide clear, natural sound uniformly distributed throughout the designated areas. System shall provide the following functions:
1. Distribute live audio to all speakers from any or all microphones in the system.
 2. Distribute recorded audio to all speakers from source equipment in the press box.
 3. Distribute live audio from any or all microphones to all speakers simultaneously with recorded playback audio.
 4. Distribute wireless signals to audience earbuds for assistive listening for the hearing impaired.
 5. Provide remote system on/off/ and volume control from the Press box.
 6. Provide wireless intercom systems for use by Team Coaches on the field and in the Press-box.
 7. Control and minimize sound levels beyond the bleacher and field areas.
- B. The system shall deliver a minimum sound pressure level of 95dB + or – 3dB at any bleacher seat with less than 1% THD.
- C. Main headend equipment rack in electrical room:
1. Floor standing of sufficient height to contain all components.
 2. Locking front and rear doors all keyed alike with six keys.
 3. Fill all unused space with blank filler panels same color as rack.
 4. Sequential AC control.
 5. Ground buss.
 6. Three space drawers.
 7. Middle Atlantic WRK-SA Series or equal
- D. Auxiliary equipment rack in press box at bleachers:
1. Wall mounted and of sufficient height to contain all components.
 2. Locking door with plexiglass panel and keyed to match main equipment rack.
 3. Fill all unused space with blank filler panels same color as rack.
 4. Three-piece sectional hinged steel rack design.
 5. Ground buss.
 6. Middle Atlantic EWR Series or equal
- E. Equipment Mounted in Main Headend Equipment Rack:
1. Digital Audio System Controller:
 - a. 32 audio channels with 24-bit A/D and D/A converters.
 - b. DSP filters, EQ, dynamics, and delays.
 - c. Dante network interface for decentralized audio control.
 - d. Matrix control of speakers.
 - e. Supervision of system functions and processes.
 - f. Freely configurable Modular Architecture with hardware expansion slots.

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- g. Equipped with modules, cards, and software to provide specified functions.
- h. Electrovoice N8000 Series or equal.
- 2. Power Amplifier:
 - a. Four independent Class D Variable Load Drive (VLD) amplifier blocks, each capable of delivering up to 1000 watts into low or high impedance loads.
 - b. Each channel configurable for maximum power into 2-ohm, 4-ohm, 70V or 100V networks without transformers.
 - c. THD at rated output power less than 0.05%.
 - d. Damping greater than 250 at 1kHz, 8-ohms.
 - e. Frequency response with ref. 1kHz into 8-ohms: 15Hz to 30kHz
 - f. Dante-enabled and connected to the control network.
 - g. Self-protected against thermal and electrical overload as well as short circuits and the occurrence of RF or DC voltage at the outputs.
 - h. Dynacord DSA 8410 Series or equal.
- 3. Amplified Monitor Panel:
 - a. Balanced line level inputs.
 - b. Visual metering for each input.
 - c. TOA MP-032B series or equal.
- 4. Control system to mute the local audio and allow override by fire alarm or signals from the main campus paging system.
- 5. Control system to provide on/off/volume controls in press box area.
- 6. Assistive Listening System by Williams Sound or equal:
 - a. FM technology system designed for large venues.
 - b. #PPA T45 series base station transmitter with rack kit.
 - c. Antennas as required to fully cover the bleachers and field
 - d. Receivers, neck loops, single mini-ear buds in quantities to serve 4% of facility occupant load as indicated on the Drawings.
 - e. Batteries for all equipment.
 - f. Wall Plaque.
- F. Equipment Mounted in Press Box Equipment Rack:
 - 1. Coaches' Intercom System shall include the following functions, features and equipment:
 - a. The system shall include two complete 2-way powered intercom systems for the Home and Visitor Teams, respectively. Each system shall be comprised of a Defense System with field and press box headsets and an Offensive System with field and press box headset. The Intercom Controller in the rack shall be able to combine these two systems by simply moving a selector switch in the equipment rack.
 - b. Two Telex PS-2001L/RMKD control units with Mid-Atlantic Security covers.
 - c. Four Telex PH-2 dual earphone headsets and six Telex PH-1 single earphone headsets.
 - d. Eight Telex BP1001 Intercom Belt Stations.
 - e. Two Telex BP2002 Intercom Belt Stations.
 - f. Telex WP-1 or WP-2 Intercom Outlets shall be provided for all locations as required. Weatherproof covers on all outside locations. Six on the field and four in the press box for a total of eight.
 - g. Four Telex ME-50, four ME-25, four ME-100 and two ME-100/2 Portable Intercom Cables.
 - h. Headset Intercom cable shall be West Penn TC1803S.

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2. Mixer for microphone and auxiliary inputs and amplified output to main equipment rack.
 3. Input for stereo audio signal from smartphone or similar device.
- G. Loudspeaker Systems.
1. Individual loudspeakers on poles mounted to Home Side and Visitor Side bleachers as indicated on Plans:
 - a. Frequency response of 100Hz to 14KHz.
 - b. Continuous power handling of 600 watts RMS, 2400W peak.
 - c. Sensitivity 105dB SPL -1w1m.
 - d. 90 x 40 coverage pattern with 70/100V 150W transformer.
 - e. All weather IEC 529 IP 44 and Mil Spec 810 Environmental specs.
 - f. 45.8-inches high x 16.9-inches wide x 12.3-inches deep, mounted with long side vertical.
 - g. Integral passive network with PTP High Frequency protection.
 - h. Electrovoice Sx600PI Series. Painted to match color of poles.
 2. Speakers attached to press box:
 - a. Frequency response of 62Hz to 20KHz.
 - b. Continuous power handling of 300 watts RMS., 600W peak.
 - c. Sensitivity 94dB SPL -1w1m.
 - d. 100 x 80 coverage pattern with 70/100V 150W transformer.
 - e. All weather IEC 529 IP 34 and Mil Spec 810 Environmental specs.
 - f. 16.5-inches high x 9-inches wide x 11.75-inches deep.
 - g. Integral frequency dividing network and full bandwidth overload protection.
 - h. Electrovoice EVID 6.2 Series with black finish.
 3. All loudspeaker systems shall be equipped with weatherproof driver covers, protective grilles, transformers in weatherproof housings, custom mounting brackets and safety cables.
 4. Custom mounting frames and hardware. Coordinate with Bleacher Installer regarding speaker installation on poles furnished with bleachers and on press box.
 5. Submit loudspeaker design for approval. Provide Drawings and data showing loudspeaker coverage using the EASE Computer Aided Design Program.
- H. Portable Equipment.
1. Microphones.
 - a. Dynamic Cardoid element.
 - b. Frequency response 50Hz to 15 KHz.
 - c. On/Off switch.
 - d. Electrovoice RE20.
 - e. Furnish four.
 2. Microphone Cables.
 - a. Two Proco M25 and two (2) M50.
 - b. Equal by Rapco or Conquest.
 3. Microphone Stands.
 - a. Two Ultimate MS07B.
 - b. Equal by Atlas.
- I. Microphone and sound receptacles shall be Switch craft of proper configuration mounted in a wall outlet with stainless steel plate or a floor box as indicated on the Plans. Plates shall be engraved with proper ID.

- J. Equipment racks shall be located in a climate-controlled area/room as shown on Drawings. Equipment racks shall be:
 - 1. Self-contained, specifically engineered racks with provisions for all present and future components as described and recommended by the Manufacturer within this Specification.
 - 2. Racks shall be accessible from front and rear.
 - 3. All program, zone, and time circuitry, data, linkage, power, telecommunications components, and circuitry to be located in racks configured as approved by the Engineer.
- K. Cable
 - 1. Microphone cable shall be West Penn TC1801.
 - 2. Sound Reinforcement system loudspeaker cable shall be West Penn TC2995. One home run from each loudspeaker device.
- L. TESTING
 - 1. Provide a Goldline TEF 25 and all other instruments for testing and adjusting of the system. Perform the following and include reports in the Owner's Manual:
 - a. Time align and balance the system.
 - b. Raw house frequency response.
 - c. On-axis frequency response after equalization.
 - d. Maximum program material sound level and head room.
 - e. Maximum system gain.
 - f. Hum and noise signal-to-noise of the overall system for each mike input channel.
 - g. Adjust system gain controls for optimum S/N ratio so that full amplifier output will be achieved with 0dBm at a line-level input.
 - h. Correct polarity of loudspeakers and mics.
 - i. Distortion is less than 5% THD.
 - j. Loss of articulation on consonances is less than 15%.
 - k. Check all circuits and wiring to verify they are free of shorts and grounds.

2.02 CHEERLEADER SYSTEM

- A. Turn over to District the following portable system:
 - 1. Anchor PB500W "Porto-Vox" or equal with two speakers and collapsible stands, hand-held wireless microphone and transmitter, two 50-foot speaker cables, vinyl covers, and rechargeable battery. System shall produce 120dB at 1meter.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. The wiring of the system shall be executed in accordance with the Drawings and the Equipment Manufacturer's wiring diagrams. Should any variations in these Requirements occur, the Contractor shall notify the Architect before making any changes. It shall be the responsibility of the Factory Authorized Distributor of the specified equipment to install the equipment and guarantee the system to operate as per Plans and Specifications.
- B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.

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- C. The labor employed by the Contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the Owner and Architect to engage in the installation and service of this system. The systems shall be installed in accordance with NFPA 70 and other applicable Codes.
- D. Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.
- E. Control Circuit Wiring:
 - 1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by System Manufacturer to provide control functions indicated or specified.
 - 2. The Contractor shall mount a main distribution frame as shown on the Plans. All wires shall be laid down on terminal punch blocks and identified by the actual room location it serves. All the communications points shall be wired into this main distribution frame, laid down in sequence, and identified by which line it is on and the point position it serves. Provide separate termination blocks for field and equipment. Cross connect circuits for proper operation.
 - 3. The Contractor shall provide necessary transient protection on the AC power feed, all station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.
- F. Wiring within Enclosures:
 - 1. Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars. The cables within the rack or cabinets shall be carefully cabled and laced with No. 12 Cord waxed linen lacing twine or ty-raps. All cables shall be numbered for identification.
 - 2. Provide physical isolation from each other for speaker-microphone, line-level, speaker-level, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker-micro- phones and adjacent parallel power and telephone wiring. Provide physical separation as recommended by Equipment Manufacturer for other Integrated Electronic Communications Network system conductors.
 - 3. Splices, Taps, and Terminations: Make splices, taps and terminations on numbered terminal punch blocks in junction, pull, and outlet boxes, terminal cabinets, and equipment enclosures. Splices of conductors in underground pullboxes is not permitted.
 - 4. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
- G. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.
- H. Grounding:
 - 1. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
 - 2. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode

returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3. The Contractor shall provide all necessary transient protection on the AC power feed and on all station, lines leaving or entering the building.
4. The Contractor shall note in his system drawings, the type and location of these protection devices as well as all wiring information.
5. The Contractor shall furnish and install a dedicated, isolated earth ground from the central equipment rack and bond to the incoming electrical service ground buss bar.

3.02 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a duly Factory Authorized Service Representative for this Project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Testing:
 1. Provide all instruments for testing and demonstrating in the presence of the Owner's Inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate System Specification.
 2. Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
 3. The Owner reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the Requirements specified herein and to accept or reject any or all of the equipment on the basis of the results thereby obtained.

3.03 CLEANING AND PROTECTION

The Contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., the Contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The Contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., Caused by the performance of this work.

3.04 IN SERVICE TRAINING

- A. Train Owner's Maintenance Personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. Provide a minimum of 8 hours training. Operators Manuals and Users Guides shall be provided at the time of this training.
- B. Schedule training with Owner through the Architect, with at least 7-days advance notice. This instruction time shall be divided as directed by the Owner.

3.05 WARRANTY

- A. The entire system shall be warranted free of mechanical or electrical defects for a period of 1- year after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the Purchaser.
- B. The Contractor shall maintain a competent service organization and shall, if requested, submit a service Maintenance Agreement to the Owner after the end of the guarantee period.
- C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address, and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

END OF SECTION 27 4110

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SECTION 27 5126

ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
 - 2. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

Submit block wiring diagrams and catalog data showing component interconnection and descriptive literature for all component parts and cabinets.

1.03 EQUIPMENT QUALIFICATION

- A. All Equipment shall conform to Federal, State and Local applicable Codes, Ordinances and AHJ, and shall be listed and labeled by Underwriters Laboratories.
- B. Assistive Listening Systems
 - 1. Assistive Listening Systems shall be provided in accordance with CBC Section 11B-219 and shall comply with CBC Section 11B-706.
 - 2. The minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of the receivers provided, but no less than two shall be hearing-aid compatible in accordance with CBC Section 11B-706.3.
 - 3. If the system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot viewing distance of, and have a complete view of, the stage or playing area. CBC Section 11B-219.4.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The Assistive Listening System shall include the following items
 - 1. Instructor (program source) wireless transmitter units.
 - 2. Student (audience) portable wireless receiver units.
 - 3. Plug-in microphones and earphones, for each unit.
 - 4. Multiple program source inputs for, Instructor's microphone, respective room Audio/Video A/V system input/output and Instructor's computer audio input/output.
 - 5. System accessories.
- B. Function
 - 1. The Assistive Listening System shall provide amplified available audio programs for hearing impaired students/audience, originating from classroom /

- stage/room Instructors and audio/video instructional program source materials, and equipment in respective building spaces, rooms, classrooms, and outdoor areas.
2. The audible program shall be transmitted wireless from the program source to the student/audience, with reception coverage throughout not less than approximately 80% of the respective floor space/area space.
 3. Shall provide automatic stereo or mono audio full system operation, depending on program source input.
 4. The system in each space shall comply with Federal ADA, State and Local AHJ Requirements for the hearing impaired.

2.02 MATERIALS (RF WIRELESS)

A. General

1. Power for each portable unit operation shall be supplied by internal, changeable rechargeable NiCad batteries and alternately by alkaline disposable batteries. Rechargeable batteries shall be recharged without removal from the unit. Each unit shall have a charging indicator light. The batteries shall be recharged from either a portable charger/organizer and with wall transformer / two-unit chargers. The units shall operate for up to 40-hours with alkaline batteries, and up to 10-hours with NiCad (NiMH) batteries. The batteries shall be rechargeable without removal from unit.
2. Provide power on-off control on each unit, to extend battery duration.
3. A protection circuit shall prevent battery "back-drain" if the power to the charger is turned off while the unit is being recharged.
4. The receivers and transmitters shall be US Government FCC and Industry Canada-approved, for FM-RF (Radio Frequency) wireless operation.
5. All components shall be the product of the same Manufacturer.
6. As manufactured by Williams Sound; or PhonicEar; or Listen Technologies; or Centrum Sound.

B. Instructors Portable (Program Source) RF Transmitter Units

1. The transmitter shall be compact, easily portable units, self-contained ABS, plastic housing/enclosure shall clip to a pocket or belt.
2. Each portable transmitter shall provide RF transmitting on one of the US Government forty different FCC – and Industry Canada-approved narrow-band channels in the 72-86MHz RF band.
 - a. Line-of-sight transmit distance range of not less than 100-feet up to 150-feet from transmitter to receiver.
3. Easy-to-read channel label and volume adjustment on the front unit face. Stereo and mono audio processing.
4. 3.5mm auxiliary input jack that allows transmission of audio from an auxiliary source such as a cassette recorder, computer, CD/DVD player or television audio source. The transmitter shall also provide a second 3.5mm microphone input source jack. The two input sources shall be simultaneously operational to provide a mixed signal output RF transmission of the two sources.
5. Select the separate independent RF transmission frequency for each transmitter to prevent transmission interference between units and to provide for at least two student receiver units to selectively overlap reception of the transmitter.
6. Quantity of Instructor's Portable RF Transmitters
 - a. Provide quantity of nine instructor portable transmitters, 3-on low band: 3-on mid band and 3-on high band RF frequencies.

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- b. Provide a quantity of one portable transmitter at the respective room Audio/Video (A/V) equipment, program output source. Provide 120-volt AC-to-DC power-supply for portable transmitter at the A/V equipment location.
 - 7. Extended range fixed base non-portable RF transmitter.
 - a. Provide fixed location non-portable base unit RF transmitter for spaces larger than 9,000 square foot indoor or outdoor spaces.
 - b. Shall have the same RF characteristics and performance as the portable transmitter except as follows:
 - 1) Line-of-sight transmits distance range of not less than 800-feet from transmitter to receiver.
 - 2) Fixed install location non-portable, with NEMA-1 metal housing.
 - 3) Radiated RF energy intensity shall provide manual attenuation adjustments to prevent multiple adjacency RF interferences.
 - c. Provide a student/audience portable RF receiver unit at the RF base unit to receive RF signals from an Instructors RF transmitter. Connect to the base unit to rebroadcast. Provide a self-contained 120-volt AC-to-DC power-supply for the portable receiver at the base unit transmitter.
 - d. Shall operate on 120-volt 60Hz AC branch circuit. Provide remote system master on-off control.
 - e. Provide remote RF antenna (outdoor/indoor) rated, for fixed base RF transmitter. Antenna shall extend the transmitter range for large spaces. Provide two RG-6 coaxial cable connects from antenna to base transmitter.
- C. Student/Audience Receiver Units
 - 1. The multi-channel narrow-band FM receivers shall be compact easily portable units, self-contained ABS/plastic housing/enclosure and shall clip to a pocket or belt.
 - 2. The receiver shall provide an on/off switch and volume control which adjusts the output level as required by the listener.
 - 3. The receiver shall have a 3.5mm output jack which accepts one of any of the plug-in listening accessories. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation.
 - 4. The receiver shall have an easy-to-read channel label on the front face. The receiver shall incorporate an automatic squelch circuit which eliminates white noise when the receiver is out of transmission range. Stereo and mono audio reception and processing.
 - 5. The multi-channel receiver shall receive any six of the US Government forty different FCC approved narrow-band FM frequencies within the 72-76MHz band from the respective transmitter units. The user shall be able to change to any one of these six frequencies by using a slide or rotary switch on the receiver. Label on the front face shall indicate the receiver is a multi-channel unit. A label inside the battery compartment shall indicate the six channels that are available to the user.
 - 6. Quantity of portable RF receivers
 - a. Provide a quantity of two receivers with matching frequencies for each transmitter, not less than eighteen total quantities of receivers.
 - b. Provide a quantity of one receiver with matching RF frequency of the transmitter at the respective room Audio/Video (A/V) equipment, program input source. Provide 120-volt AC-to-DC power-supply for portable receiver at the A/V equipment location.

- c. Provide hearing aid compatible units at a ratio of one per four receivers in accordance with ADA 219.3.
- D. RF System Accessories
 - 1. Battery recharger portable charger/organizer pack.
Locking, portable case with cover, shall accept a group of not less than twelve plug-in portable transmitter and receiver units in each pack for simultaneous multi-unit battery recharging. Provide a quantity of one organizer for each quantity group of twelve (or fraction thereof) transmitters/receivers provided as part of the Contract.
 - 2. Stereo audio headset style automatic noise canceling microphone, integral on-off-volume control and with behind the neck support style each with cable and outlet plug-jacks to match transmitter jacks. Provide two cables for each transmitter.
 - 3. Equipment wall mount support brackets.
 - 4. Auxiliary audio program source 15-feet long cables with plug-in at both ends to match transmitter jacks. Provide two for each transmitter.
 - 5. Stereo audio headset style earphones with cable and plug to match receiver jacks. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation. Provide one headset for each receiver.
 - 6. Rechargeable Ni-Cad (NiMH) batteries, one complete set for each transmitter and receiver unit.
 - 7. Locking auxiliary equipment storage cases for cables, microphones and headsets, with quantity and capacity for all auxiliary accessories furnished as part of the Contract.

2.03 MATERIAL (INFRARED WIRELESS)

- A. General
 - 1. All equipment shall be the product of the same Manufacturer.
 - 2. The receivers and transmitters shall be US Government, FCC and Industry Canada-approved.
 - 3. Provide power on-off control on each unit, to extend battery duration.
 - 4. As manufactured by Williams Sound; or PhonicEar; or Listen Technologies; or Centrum Sound.
- B. Master (Program Source) Transmitter (Infrared Emitter) Units
 - 1. The infrared emitter/transmitter shall be compact, portable units, self-contained ABS/plastic housing/enclosure.
 - 2. The emitter panel shall be a dual-channel system operating on both 2.3 and 2.8MHz invisible infrared light waves frequencies. The channels shall be designated "CHANNEL A" for the left and "CHANNEL B" for the right.
 - 3. The emitter shall provide left and right AUDIO IN jacks to accept an input signal from a sound system, left and right "SYNC IN/SYNC OUT" jacks for master/slave daisy-chaining with other emitters if desired, and left and right "MIC-IN" jacks to accept an audio signal from a microphone or Audio/Video preamplifier.
 - 4. The emitter shall provide separate LED input level detectors for each channel which illuminate when the audio signal peaks. Stereo and mono audio processing.
 - 5. The emitter shall be mounted by the following methods:
 - a. Fixed to a wall with an adjustable, wall-mounting support bracket accessory.

- b. Portable mounted to a table-top-or floor-stand, using accessory support-stand adapter.
6. Each emitter shall provide an array of not less than 130-infrared LEDs covered by an infrared transparent acrylic lens. The infrared signal from each emitter shall cover not less than 3,000 square feet (32,000 cubic feet) enclosed space. Note: For room sizes smaller than 3000 square feet, the infrared transmitter/emitter infrared output shall be reduced to accommodate the actual smaller room square feet size and height.
7. 120-volt 60Hz AC input to nominal 24-volt DC output (plug-in “power-brick”) power supply external transformer shall be UL approved, with cable “plug-in” connection to emitter/transmitter. Provide remote system master on-off control.
8. Slave emitter/transmitter for rooms exceeding 30,000 cubic feet. Provide one additional infrared emitter/transmitter repeater slave unit, for each additional 30,000 cubic feet room volume, or fraction thereof. The slave repeater shall receive and retransmit the program signals from the master unit. Provide one 100-foot long “master-to-slave” auxiliary portable extension wire cable for each slave unit.
9. Provide wall mount plug-in outlets for instructors’ microphone outlet connect ports to emitter/transmitter.
 - a. Provide 1.0-inch conduit and wire, homerun connect from microphone outlet to each room respective emitter/transmitter and slaves. Provide conductors as recommended by Manufacturer.
 - b. Provide 1.0-inch conduit and wire homerun connect from microphone outlet to respective room Audio/Video (A/V) equipment, microphone program source input. Provide conductors as recommended by Manufacturer.
10. Provide a quantity of nine emitter/transmitter “master” units, plus additional “slave” units for adjusted room sizes.

C. Student/Audience Receiver Units

1. Battery Power
 - a. Power for each unit operation shall be supplied by internal, changeable recharge-able NiCad batteries and alternately by alkaline disposable batteries. Rechargeable batteries shall be recharged without removal from the unit. Each unit shall have a charging indicator light. The batteries shall be recharged from either a portable charger/organizer and with wall transformer/two-unit chargers. The units shall operate for up to 40-hours with alkaline batteries, and up to 15-hours with NiCad (NiMH) batteries.
 - b. Provide power on-off control on each unit, to extend battery duration.
 - c. A protection circuit shall prevent battery “back-drain” if the power to the charger is turned off while the unit is being recharged.
2. The receiver shall be a dual-channel unit for wearing around the neck with an adjustable strap. Stereo and mono audio reception and processing.
3. Compatible with the transmitter (emitter) and operate on 2.3MHz and 2.8MHz frequencies invisible infrared light waves. Self-contained and switchable from “CHANNEL A” to “CHANNEL B” through a switch located on the back of the unit.
4. The receiver shall provide an infrared light-gathering lens on the front of the unit to focus the light signal from the emitter onto the infrared detector element. The receiver shall detect and decode the infrared emitter/transmitter light source within a 160° acceptance angle.

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5. Audio squelch circuit which turns the output circuit off when the infrared signal is reduced or not received, with on/off and volume control.
 6. Output jack, which accepts any of the listening accessories. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation.
 7. Shall be compact easily portable units, self-contained ABS/plastic housing/ enclosure with red infrared receiver lens. Shall clip to pocket or belt.
 8. Provide quantity of two infrared receivers for each master transmitter, not less than eighteen total quantities of receivers.
- D. Infrared System Accessories
1. Battery recharger portable charger/organizer pack.
Locking, portable case with cover, shall accept a group of not less than twelve plug-in portable transmitters and receivers' units in each pack for simultaneous multi-unit battery recharging. Provide a quantity of one organizer for each quantity group of twelve (or fraction thereof) receivers provided as part of the Contract.
 2. Stereo audio headset style automatic noise canceling microphones, integral on-off-volume control and with behind the neck support style. Each with 25-foot long extension cables and outlet plug-jacks to match transmitter outlet jacks. Provide two cables for each emitter/transmitter.
 3. Equipment wall mount support brackets.
 4. Auxiliary audio program source 15-foot long cables with plug-in at both ends to match transmitter jacks. Provide two for each transmitter.
 5. Headset style earphones with cable and plug to match receiver jacks. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation. Provide one headset for each receiver.
 6. Rechargeable Ni-Cad (NiMH) batteries, one complete set for each unit.
 7. Locking auxiliary equipment storage cases for cables, microphones and headsets. Quantity and capacity as required to store all accessories.
 8. Portable floor stand, for infrared emitter/transmitter units mounting and support, with variable height adjustment and tip-resistant weighted base. Provide one floor stand for each infrared emitter/transmitter.
 9. Locking, portable case for infrared emitter/transmitter. One for each emitter/transmitter unit.
 10. Provide microphone extension cable with plug to match microphone and infrared emitter / transmitter microphone input jack, 25-foot length. One for each microphone.

PART 3 - EXECUTION

3.01 GENERAL

- A. Each System General
1. Assemble, set up, and test each transmitter, receiver, and accessories units.
 2. Install and fully charge all batteries prior to and after testing/set up is complete.
- B. Wireless RF Units
1. Perform an onsite RF frequency survey to determine available unused RF channels, prior to selecting unit operating channels and prior to ordering the equipment.
 2. Select operational RF frequency to prevent system RF interference is with other equipment.

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3. Provide - one 0.75-inch conduit with two Category-6A, ANSI/EIA/TIA-568C 4-pair, UTP cables connecting from each emitter/transmitter master outlet box location to respective room instructors microphone outlet box location. Provide matching RJ-45 Category-6A female jacks at each outlet box for each cable. Provide an audio circuit matching Balun at each outlet RJ-45 jack location, for RJ-45-to-portable cable plug-in transition and circuit impedance matching audio/transformer, into respective equipment. Additionally, provide four portable Category-6A patch cables with RJ-45 jacks on each end of 7-foot long patch cable. Typical for each outlet location.
- C. Wireless Infrared Units
1. Provide aiming and intensity adjustments of emitter/transmitter units to insure complete room coverage.
 2. Provide - one 0.75-inch conduit with two Category-6A, ANSI/EIA/TIA-568C 4-pair, UTP cables connecting from each emitter/transmitter master outlet box location to respective room instructors microphone outlet box location. Provide matching RJ-45 Category-6A female jacks at each outlet box for each cable. Provide an audio circuit matching Balun at each outlet RJ-45 jack location, for RJ-45-to-portable cable plug-in transition and circuit impedance matching audio/transformer, into respective equipment. Additionally, provide four portable Category-6A patch cables with RJ-45 jacks on each end of 7-foot long patch cable. Typical for each outlet location.
 3. Provide - one 0.75-inch conduit with two Category-6A, ANSI/EIA/TIA – 568C, 4-pair UTP cables connecting from each emitter/transmitter master outlet box location to respective room audio amplifier/preamplifier location. Provide matching RJ-45 Category-6A female jacks at each outlet box location for each UTP cable. Provide an audio circuit matching Balun at each outlet RJ-45 jack location, for RJ-45-to-portable cable plug-in transition and circuit impedance matching audio/transformer, into respective equipment. Additionally, provide four portable Category-6A patch cables with RJ-45 jacks on each end of 7-foot long patch cable. Typical for each outlet location.

**END OF SECTION 27 5126
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SECTION 28 3100

INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26, 27 and 28.
 2. General Provisions and Requirements for electrical work.

1.02 QUALIFICATION OF BIDDERS AND EQUIPMENT

- A. To qualify as an acceptable Bidder, whether the bid is submitted to the District, his Agent, a General Contractor or a Sub-Contractor, the System Bidder or Contractor shall be Qualified Contractor and shall hold a valid License issued by the State of California Department of Consumer Affairs Collection and Investigation Services for the purpose of installing security systems. The System Bidder or Contractor shall hereinafter be referred to as the Contractor. The Contractor shall hold all other licenses required by the legally constituted Authorities Having Jurisdiction over the work. The Contractor shall be the Factory Authorized Distributor for the branch of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least 5-years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall be financially able to provide a performance bond covering the work and the guarantee described. The Contractor shall provide that bond if requested.
- B. The Equipment specified herein shall be DMP #XR-500N or equal.
- C. The System shall be serviced by a field supported 2-year warranty.
- D. The Specification is based on the Equipment of Manufacturers who has been approved by the District and the Manufacturers herein named shall be considered as meeting the Requirements of this Specification. For all items which are identified by part number and Manufacturer the Performance Specifications which are published in the most recent Manufacturers data sheets available at the time of bidding this Project shall be applicable to the present work as though fully written out herein.
- E. All Equipment shall conform to all Local Applicable Codes and Ordinances and shall be listed by Underwriters Laboratories.
- F. Installation Certification
1. Work and Material for Cables, cable terminations and related components shall be performed by Certified Installers. The Installer shall be certified by the respective Product Manufacturers.
 2. The Manufacturers of the indicated work and material shall provide an Installer education/training and Certification Program for the supplied products.

3. The Installers performing the Contract Work for the indicated products shall have attended and successfully completed each of the respective Manufacturer's installation Training Education Programs for the specified products.
4. Submit six copies of the Manufacturer's Certifications for each Installer performing the work. The submittal shall be approved prior to initiating any related Contract Work.
5. Contract material installed, and work performed by Installers not complying with these Requirements shall be removed. Removal of work and material not in compliance with these Requirements shall be done at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions. New material and work required to replace the non-complying removed work and material shall be provided at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide Main Control Panel, Terminal Cabinets, Keypads, and Site Underground Conduits as indicated.
- B. Provide Motion Sensor(s) in each room having exterior doors, exterior glass, or skylights. Quantity of sensors in each room shall be as required to detect entry through exterior doors, exterior glass, or skylights.
- C. Provide a Magnetic Switch at the entry door to each building, near its respective keypad. Connect to the system to initiate a timing circuit for keypad operation.
- D. Provide Magnetic Switches at roof hatches.
- E. Provide all conduits, cabling, and outlet boxes required for a complete and operable system.
- F. Meet with Representatives of the District at a time and location convenient to the District. Advise the District of programming options and incorporate all Requirements onto the Shop Drawings before submittal to the Architect.

1.04 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Submit Evidence of having met with District Representatives as specified herein.
- B. Submit Product Data Sheets for all switches, keypads, wiring devices, device plates, controllers, power supplies, cabinets, etc.
- C. Submit Detailed Shop Diagrams including Dimensioned Plans, Elevations, Details, Schematic and Point-to-Point Wiring Diagrams and descriptive literature for all component parts and cabinets.
- D. Submit six copies redrawn Building Floor Plans showing all components of the intrusion detection system including interconnecting cabling and conduits. Sensors shall be located on the Drawings in the location conforming to the Requirements stated herein. Drawings shall be prepared to scale and show all exterior glass, exterior doors, all interior and exterior building walls, roof hatches, Architectural and

Structural Elements relevant to the installation of the system. Each zone shall be shown on the Plans.

PART 2 - PRODUCTS

2.01 SYSTEM FUNCTIONS

- A. Provide a Complete and Operable Supervised Intrusion Detection System as shown on the Plans including but not limited to master control panel, key pad stations, motion detectors, connections to door switches, a State Fire Marshal listed digital communicator and an automatic dialer.
- B. Upon Detection of an intruder by initiation of any device in the system, the system shall cause the annunciator LED to light and sound an alarm signal on the school's telecommunication system. Alarm information shall be sent by digital dialer to Central Station Alarm Monitoring Agency.
- C. Systems shall detect the motion of a body taking not more than four steps in an area secured with motion detection equipment where entry doors or windows are possible access.
- D. Each Building Area shall be on a separate zone with each zone controlled separately so that any building area may be secured while others remain unsecured.
- E. The System shall be capable of off-site computerized access for remote access, programming, and control.

2.02 CONTROL PANEL

- A. Control/Communicator Panel shall be a DMP control panel with an integral digital communicator and shall be Underwriters Laboratories listed. All external circuit connections shall be UL listed as power limited in accordance with the provisions of Article 760 of the California Electrical Code (CEC).
 - 1. Provide Point of Protection (POPEX) modules at the control panel for Popit module supervision.
 - 2. Provide Point of Protection Identification Transponders (Popit) modules at building terminal cabinets to individually identify each detector in the system.
- B. The Control/Communicator shall be IP based.
- C. System shall include the following features:
 - 1. Real time clock and test timer.
 - 2. Battery charging circuit.
 - 3. Battery voltage supervision.
 - 4. Supervised automatic reset circuit breakers.
 - 5. Onboard warning buzzer and diagnostic LEDs.
 - 6. Automatic answer modem.
 - 7. Lightning and RFI protection.
 - 8. Central Station reporting format.
 - 9. Printer/CRT interface module for on-site serial data printer recording or CRT display of events.
 - 10. Quad serial output module for enhanced serial data interface capability for specific accessory modules and devices.
 - 11. Individual zone responses.

12. Custom annunciator text.
13. Audible alarm output, steady or pulsed.
14. Automatic silencing.
15. Attack-Resistant enclosure and lock meeting Underwriters Laboratory Local Burglary Requirements.
16. A minimum of eight auxiliary form "C" dry contacts for a variety of programmable responses to alarm and trouble conditions.
17. Transformer enclosure for internal mounting of Class 2 transformer.
18. Two telephone numbers with selective signaling options.
19. Individual zone responses.
20. Automatic test reports.

2.03 BAR-CODE PROGRAMMER FOR DIAGNOSTICS AND PROGRAMMING CAPABILITY.

2.04 RECEIVER

- A. Receiver shall be Bosch Security System #D6600 Series, UL listed for fire and intrusion detection.
- B. Provide a 50VA Class 2 plug in transformer for power input.
- C. System shall contain 48 hours of standby power utilizing rechargeable sealed lead acid batteries and a battery charger.
- D. System shall be FCC approved for telephone connections.
- E. An Alphanumeric LCD Display shall indicate account number, area number, time, date, event, zone or point number, line or group number, status, and external devices.
- F. Twenty-four-hour Clock and 128-year calendar.
- G. Forty Character Line internal printer and interface capability with an external serial printer.
- H. Transmission Verification appropriate with the format utilized.
- I. Storage of 249 separate events.
- J. Transmission Format shall support the control panel.
- K. Turn the Receiver over to the District for Central Station or Campus Monitoring.

2.05 REMOTE ACCOUNT MANAGER

- A. System shall be Bosch Security Systems #D5300 Series or equal with all equipment necessary for computerized access, programming, diagnostics, and remote control of the system. It shall be possible to remotely change passcodes, locate faults, shunt problem zones, arm and disarm the system, silence alarms, and control the auxiliary output contacts in the control panel.
- B. System shall permit remote diagnostics including utility and battery power conditions, phone line condition, event memory by zone, and current clock and calendar settings.

- C. System shall be 100% IBM compatible for use with personal computers.
- D. System shall include a plug-in modem and software necessary for a complete and operable installation. Furnish the District with a Software License Agreement for updated software enhancements as they develop.

2.06 KEYPADS

- A. Master Keypad shall be DMP or equal capable of displaying system status and controlling the alarm system. Unit shall receive its operating power from the main control panel. Keypad shall be flush mounted on a wall near the entry doors of each building. Faceplate shall be brass or stainless steel as selected by the Architect.
- B. Sub-Zone Keypads shall be DMP or equal to allow individual zones to be bypassed. Keypad shall be flush wall where shown on Plans Faceplate shall be brass or stainless steel as selected by the Architect.

2.07 MOTION SENSORS

Motion sensors shall be Honeywell DT-7450 with Bosch B328 mounting bracket. Sensors shall be dual performance, dual event devices to minimize false alarms or equal passive infrared devices detecting thermal motion signals. Sensor coverage patterns shall be as required for optimum coverage at each individual location. Sensor shall be adjustable Gimbal mounted with plate and outlet box. Provide an attack resistant enclosure DS AE774 at Multipurpose and Gymnasium areas.

2.08 MAGNETIC SWITCH

Magnetic Switch shall be fully concealed in the door frame, Admeco, Sentrol or equal.

2.09 INTRUSION DETECTION SYSTEM TERMINAL CABINET

Each Intrusion Detection System Terminal Cabinet shall contain a power supply for motion sensors and/or POPIT/POPEX (Zonex) modules.

2.10 CABLING

Cabling shall be as required for system operation. All cabling shall be shielded.

2.11 SIREN

Siren shall be ATW (Mascon) PR-D550PW or equal.

PART 3 - EXECUTION

3.01 CONNECTIONS THROUGHOUT THE SYSTEM

All connections throughout the system shall be soldered, crimped by means of AMP lugs, fastened with screw type terminals, made by Spring Tension Clip "punch block" terminals or made by standard plugs and receptacles. Each wire twisted pair or cable shall be tagged throughout the site with EZ Markers with the room number it serves. All conductors in terminal cabinets shall be carefully formed and harnessed in a workmanlike manner.

3.02 SYSTEM CABLING

All System Cabling shall be installed in conduit except where wiring occurs above accessible ceilings. Wiring not in conduit shall be UL listed plenum-type cable. All wiring in walls shall be in conduit. All conduits shall be run concealed. Where Architecture precludes concealed conduits, run conduits on top of beams or trusses and minimize the

exposure to view. Identify on the submittal Drawings all locations where conduits must run exposed.

3.03 MOTION SENSORS

Locate motion sensors to provide optimum coverage of the space and to avoid conflicts with the Architectural Aesthetics of the building. Submittal Drawings shall show the exact locations of all system sensors and keypads for approval by District's Maintenance Managers.

3.04 COORDINATE CONCEALED DOOR SWITCH INSTALLATIONS WITH FINISH HARDWARE MANUFACTURER.

3.05 SYSTEM PROGRAMMING

Provide all system programming as required by the District's Maintenance Managers, including the necessary product handlers, so that all parameters are entered into the system and the annunciator displays a text, which is customized to the facility.

3.06 SYSTEM TESTING AND DOCUMENTATION

- A. Before the Contract shall be considered complete, the Contractor shall program the system per District Requirements and demonstrate the performance of the system in the presence of the District. The Contractor shall provide all test and reception gear required to prove the performance as outlined.
- B. Actuate Motion Sensing Devices and Verify that the system performs as specified.
- C. The Communication Loops shall be opened in at least two locations per building to check for the presence of correct supervisory circuitry.
- D. When the Testing has been completed to the satisfaction of both Contractor's Job Foreman and the Representatives of the Manufacturer and the DSA Inspector, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be provided by the Contractor and forwarded to the Architect.

3.07 SYSTEM TRAINING

Provide a minimum of two 4-hour periods to instruct District Personnel in proper operation of all systems. The first instructional period shall be held prior to final acceptance of the systems. Instructional training shall be done at the Project Site and shall be conducted by Factory-Trained Technical Personnel. Furnish the District with videotape VHS cassette(s) of the first instruction session. The second instructional period shall be within a period of 1-year after final acceptance of the systems, upon request of the District.

END OF SECTION 28 3100

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SECTION 28 4600

FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26.
 2. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Submittal Documentation
1. Submit State Fire Marshal, AHJ and UL Listing numbers for each item of fire alarm system equipment and components.
 2. Submit Manufacturer's standard catalog data for each fire alarm components. The submittal shall be arranged in the order of the Specification and shall list the Specification paragraph number, the name, the proposed model and Manufacturer for each item as well as a reference indicating the specific piece of data which can be easily located in the brochure. The Manufacturer's data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of item. The data sheet shall completely describe the proposed item including listing numbers. Where modification to the equipment is necessary to meet the Operational Requirements of the Contract Documents, the brochure shall include complete Mechanical and Electrical Shop Drawings detailing the modification. The brochure shall include a listing of the outlet rough-in needed for every device and equipment item. The applicable symbol, which illustrates that rough-in item on the Drawing Plans, shall be shown in the submittal opposite the description of the rough-in to facilitate locating the data by Field Personnel. Submit elevation and dimensional information.
 3. Submittal for Fire Alarm Testing – Test Plan sequence, procedures, tester qualifications and blank test forms.

1.03 APPLICABLE STANDARDS (ADDITIONAL REQUIREMENTS)

- A. General
1. The equipment shall be listed, labeled, and approved for the application shown in the Contract Documents, as fire alarm equipment complying with the most recent versions of the Install Requirements of the following applicable Standards. The following Standards shall become Requirements of and are included in the Contract Documents:
 - a. Factory Mutual Approval Guide (FMAG)
 - b. United States Department of Justice Rules for Building Accessibility by the Handicap (ADA).
 - c. The Equipment Manufacturer Guidelines.

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- d. State Building Codes, Local Building Codes and Authorities Having Jurisdiction (AHJ).
 - e. National Electrical Contractors' Association: NECA-305, Recommended Practice for Installing Fire Alarm Systems.
- B. National Fire Protection Agency (NFPA)
 - 1. NFPA 72, National Fire Alarm Code.
 - 2. NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
 - 3. NFPA 70, National Electrical Code (N.E.C.), and N.E.C. Article 760.
 - 4. NFPA 101, Life Safety Code.
- C. Underwriters Laboratory (UL)
 - 1. UL 864, Control Units for Fire Protective Signaling Systems.
 - 2. UL 268, Smoke Detectors for Fire Protective Signaling Systems.
 - 3. UL 268A, Smoke Detectors for Duct Applications.
 - 4. UL 521, Heat Detectors for Fire Protective Signaling Systems.
 - 5. UL 228, Door Closers-Holders for Fire Protective Signaling Systems.
 - 6. UL 464, Audible Signaling Applications.
 - 7. UL 1638, Visual Signaling Appliances.
 - 8. UL 38, Manually Actuated Signaling Boxes.
 - 9. UL 346, Water flow Indicated for Fire Protective Signaling Systems.
 - 10. UL 1481, Power supplies for Fire Protective Signaling Systems.
 - 11. Note: Provide the complete, installed, and tested fire alarm system with an Underwriters Laboratory Field Certification from an independent third-party Alarm Service Company, Designated and Authorized by UL for fire alarm certification.
- D. The California State Fire Marshal, California Building Code (CBC) and California Fire Code (CFC)
 - 1. Building Standards Administrative Code, Part 1, Title 24, C.C.R.
 - 2. California Building Code (CBC), Part 2, Title 24, C.C.R.
 - 3. California Electrical Code (CEC), Part 3, Title 24, C.C.R.
 - 4. California Mechanical Code (CMC), Part 4, Title 24, C.C.R.
 - 5. California Plumbing Code (CPC), Part 5, Title 24, C.C.R.
 - 6. California Fire Code (CFC), Part 9, Title 24, C.C.R.
 - 7. California Referenced Standards Code, Part 12, Title 24, C.C.R.
 - 8. Title 19, C.C.R., Public Safety, State Fire Marshal Regulations.
- E. Installation and Testing Completion
 - 1. Written Certification by the Fire Alarm Equipment Manufacturer shall be submitted to the Owner's Representative, stating that the proposed system and its component parts are Listed and Approved by UL, the State Fire Marshal, and/or AHJ.
 - 2. Upon completion of installation, written Certification by the Contractor and Fire Alarm Equipment Manufacturer shall be submitted to the Owner's Representative Certifying the installation has been tested, is operational and conforms to the Requirements of the Contract Documents, applicable Building Codes and AHJ.

1.04 EQUIPMENT QUALIFICATIONS

A. General

1. As directed by the Owner, no other Manufacturer is acceptable. The equipment shall be as manufactured by Notifier.
2. The Fire Alarm Manufacturer products described are required by and at the specific direction of the Owner and approved by the Owner. Fire alarm system items described by Manufacturer's part number, shall comply with the Performance Specifications published by the Manufacturer's most recent catalog data sheets at the time of bid date and shall become the Requirements of the Contract Documents.
3. The Fire Alarm System Installation Company shall be an authorized Distributor and Service Provider for the fire alarm system equipment specified in the Contract Documents and furnished as part of Contract Work. The Fire Alarm Installation Company shall be certified, and their staff shall be trained for the fire alarm system equipment furnished as part of Contract Work. Provide six copies of written documentation from the Fire Alarm System Manufacturer demonstrating compliance in good standing with the "Authorized Distributor," "Service Provider," "certification" and "training" Requirements.
4. A Fire Alarm System Technician Authorized by the Manufacturer of the fire alarm system shall supervise the Contractors installation, testing, certification, and instruction of Owners' Personnel in the operation of the fire alarm system. The Technician shall be experienced with the specific system and licensed in the respective State for Fire Alarm Systems.
5. NICET – National Institute for Certification in Engineering Technology:
 - a. The Contractors' Fire Alarm Field Installation Personnel shall be NICET (Level-2 or greater) Certified in fire alarm systems.
 - b. Submit documentation showing compliance of NICET current valid Certification for Key Personnel.

PART 2 - PRODUCTS

2.01 GENERAL SYSTEM OPERATION

A. Alarm Conditions

1. Actuation of any manual or automatic alarm initiating device, connected to the fire alarm system shall cause the following automatic functions. The automatic functions and actions shall be selectable by fire alarm system software program control functions and shall comply with the AHJ Requirements:
2. Audio and visual alarm evacuation signaling units shall activate continuously. Provide evacuation alarm "Coded" signaling and zoning to comply with AHJ.
3. The respective zone alarm annunciator and annunciator displays on the fire alarm control panel, remote annunciator panels, and remote annunciation/monitoring equipment shall be activated.
4. Activate the central alarm system, offsite central station equipment interface and activate telephone/dialer monitoring lines.
5. Activate building security/intrusion detection control system automatic door unlocking mechanisms for security doors located in the exit egress paths.
6. Actuation of automatic smoke detector self-contained fire/smoke doors/hatches or actuation of area smoke detectors located on either side of smoke/fire doors/hatches or actuation of the fire evacuation alarms shall energize the release mechanism and cause the following actions:
 - a. Close all fire/smoke doors and hatches.

- b. Close only the fire/smoke door/hatches at the location of the activated smoke detector.
 7. Actuation of any fire sprinkler flow switch shall energize the operating mechanism and cause the following actions:
 - a. Close all fire/smoke doors and hatches.
 - b. Shut down all or software program selected respective HVAC fans and motors monitored and controlled by the fire alarm system.
 8. Provide and perform any additional functions as specified herein, shown on the Drawings/Contract Documents, or required by the Fire Marshal, and AHJ.
- C. Trouble Condition
 1. Actuation of any status or supervisory trouble condition connected to the fire alarm system shall be monitored and cause the following automatic functions:
 - a. Activate the respective alarm zone trouble remote annunciator panels and annunciator display on the fire alarm control panel, remote annunciator panels and remote annunciation/monitoring equipment.
 - b. Sound and audible trouble signal on the fire alarm control panel, remote annunciator panels, and remote annunciation/monitoring equipment.
 - c. Activate the offsite central station trouble monitoring circuit.
 2. Monitor and detect trouble/failure in any fire alarm systems electrical and electronic circuits, displays, operating software, communications devices, operator controls and equipment control devices.
 3. Monitor and detect trouble that may prevent proper operation of any fire alarm initiating device/circuit, evacuation alarm device/circuit, communications device/ circuit, control device/circuit etc., including breaks and/or shorts in circuits and display a trouble condition.
 4. Actuation of any fire sprinkler shut-off valve tamper switch shall activate a separate zone and display trouble condition for each valve. The trouble zone shall be completely independent of the fire sprinkler flow switch zone, and completely independent of any other fire alarm zone.
 5. Each 120-volt AC electric power source connected to any fire alarm system component shall be monitored with indication by a "power on" display annunciator. Upon normal source power outage, the system shall activate a power trouble condition display, and indicate a trouble condition.
 6. Monitor the standby batteries and, upon a low battery condition or battery charging failure, activate the low battery display and indicate a trouble condition.
 7. System ground detection shall be provided for the entire system. Upon ground detection, activate the ground detection display and indicate a trouble condition.
 8. Smoke detector "pre-clean" pre-trouble condition and secondary "dirty-detector" trouble condition activate the respective detection display and indicate a trouble condition.

2.02 EXISTING FIRE ALARM CONTROL PANEL (FACP)

Modify and Upgrade the Existing FACP to Fully Interface with the New Construction.

2.03 MANUALLY ACTIVATED ALARM INITIATING DEVICES

- A. General
 1. An electronic, digital network/multiplex, addressable module shall be incorporated into each device. The device shall communicate the alarm condition, the status condition, and the trouble condition of each device, with

digital electronic unique address codes for each device. The device shall bi-directionally communicate with; be supervised by; and monitored by the fire alarm control panel. Address assignments shall be set electronically and reside at the device location in non-volatile memory. Memory shall be maintained during electric power outage.

2. Devices shall be suitable for use on a Class "A" 4-wire (Class "B" 2-wire) supervised alarm initiating circuit.
3. Screw type terminals with numbered identification shall be provided for each "in-out" connections of the alarm circuit wiring.
4. The face of the station shall have lettering indicating "FIRE" and operational instructions. Stations shall be tamper resistant. Semi-flush mounting in an outlet box unless indicated otherwise on the Drawings.
5. Auxiliary spare switch contact shall be provided for control of remote devices rated 120 volts, 60Hz, AC, 1-amp minimum.
6. Stations shall provide visual indication the station has been activated. A key (and/or special tool) shall be required to gain access into the station to reset the station after being activated.
7. Stations shall be "break-glass" or "non-break- glass" type as required by Local Fire Marshal or indicated on the Drawings.
8. RF noise, lightning protection and transient voltage filtering shall be provided internally in the device.
9. The devices shall operate in ambient air environment as follows:
 - a. Temperature Centigrade 0 degrees to 49 degrees
 - b. Humidity 0 to 95% non-condensing
 - c. Elevation Sea level to 15,000 feet.
10. Shall comply with State of California Handicap Requirements and Federal ADA Requirements, for Operation Personnel and public use.

B. Manual Pull Stations

1. Pull stations shall be non-coded single action or double action, requiring a manual "pulling" action to initiate the fire alarm.
2. Pull stations installed outdoors shall be weather resistant construction, "double action" type to activate the pull-station.
3. Provide a clear plastic, high impact, vandal resistant, hinged cover for each manual pull station as follows. The cover shall be listed for use as a fire alarm system manual pull station cover; shall incorporate a local alarm audible signal which "sounds" as the cover is lifted, with a label explaining the proper operation. Provide anti-theft cable connect from cover to frame. The cover alarm shall be powered directly from the respective pull station alarm initiating circuit. Provide additional 9-volt, DC battery tamper alarm buzzer backup tamper alarm power supply.
 - a. All pull-station locations installed outdoors exterior to the building.
 - b. All pull-station locations installed in an indoor room location with an occupancy exceeding fifty people.

2.04 AUTOMATIC ALARM INITIATING DEVICES

A. General

1. An electronic digital, network/multiplex, addressable module shall be incorporated into each initiating device. The device shall communicate the alarm condition; the status condition; the trouble condition of each device, with digital electronic unique address codes for each device. The device shall bi-directionally communicate with; be supervised by; and monitored by the fire

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- alarm control panel. Address assignments shall be set electronically and reside at the device location in non-volatile memory. Memory shall be maintained during electric power outage.
2. Devices shall be suitable for use on a Class "A", 4-wire (Class "B", 2-wire) supervised alarm initiating circuit.
 3. Screw type terminals with numbered identification shall be provided for each "in-out" connections of the alarm circuit wiring.
 4. Surface mount devices on a flush mounted outlet box, unless indicates otherwise on the Drawings.
 5. Auxiliary double throw spare relay contact shall be provided for activation of remote rated devices 120V, 60Hz, AC, 1-amp minimum.
 6. Initiating devices shall be reset and tested from the fire alarm control panel and shall not require local individual resetting or testing.
 7. LED mounted on device, with continuous LED illumination and flashing LED illumination shall be used to differentiate between alarm/trouble conditions and normal operations
 8. RF noise, lightning protection and transient voltage filtering shall be provided internally in the device.
 9. Detector Base
 - a. Low profile fixed base, with "twist-lock" mounting for detection device "plug-in" connection and with fire alarm system wiring terminals. Tamper resistant lock/ screw shall prevent unauthorized removal of the detector device from the base without the correct "tool/key".
 - b. The plug-in base shall provide the network/multiplex unique identification address monitored by the fire alarm control panel, to prevent accidental mis-location of the device address in the event the detector device is removed and relocated as part of the fire alarm system repair/preventative maintenance.
 - c. In addition to the detection device, the base shall provide for the addition of independent individually addressable fire alarm system modules integral to the base. The modules shall be controllable by software programs from the fire alarm control panel. Operation of the modules shall be independent of the quantity of detectors and quantity of modules on the circuit or the quantity of devices in an alarm state. The modules shall provide the following function types:
 - 1) Electromechanical relay for selective "on-off" contact switching of external electrical circuits, local to the respective initiating devices.
 - 2) Audible fire evacuation alarm horn/buzzer device with not less than 85dB sound intensity measured at 10-feet horizontally from the unit.
 10. The devices shall operate in ambient air environment as follows: Automatic "drift" compensation of sensitivity shall maintain sensitivity settings by automatically compensating for effects caused by outside environment and dirt contamination sources:
 - a. Temperature Centigrade 0 degrees to 49 degrees
 - b. Humidity 0 to 95% non-condensing
 - c. Elevation Sea level to 15,000 feet
- B. Smoke Detector
1. Detectors shall comply with UL Standards 268, 167 and 168 (latest revisions) and shall use solid state electronic circuits throughout.
 2. The smoke detector shall operate on a total of two circuit wires. Alarm signaling, communication, and detector power shall use the same conductors.

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3. Detector sensitivity shall be adjustable at the sensor and from the fire alarm control panel. An automatic circuit shall compensate for detector aging and dirt accumulation; the dirt/aging compensation shall be adjustable by software programming functions from the fire alarm control panel.
 4. A fine mesh insect screen shall be provided on all detector openings.
 5. The detector shall lock-in on alarm with local reset and fire alarm control panel remote reset. An electromechanical test feature shall provide functional testing of the unit with-out smoke.
 6. Detection sensing methods:
 - a. Photo electric type smoke detectors shall employ a Light Emitting Diode (LED) as the detector light source, activated by the presence of combustion smoke products. Failure of the LED shall activate the alarm/trouble light on the detector.
 - b. Ionization type smoke detector shall employ the triple chamber, dual chamber ionization principle, activated by the presence of combustion products. The ionization chamber shall be RF shielded.
 - c. The detector shall also incorporate a fixed temperature heat detector rated at 135 degrees F. The heat detector shall operate the alarm circuit and alarm/trouble light.
 7. Plug-in "twist-lock" detector connection to a fixed mounting/connection detector base.
 8. Area protection smoke detector, photo electric or ionization type, and with internal fixed temperature heat detector. Self-contained inside a protective housing/cover. Suitable for open area coverage and for installation on a wall (vertical) location, or on a ceiling (horizontal) installation location.
 9. Smoke detectors installed in HVAC air plenums, above ceiling or in floor spaces, shall be listed, and approved for the actual installation location.
- C. Fire Detector - Heat
1. Heat detectors shall be dual action electro-thermostatic combination rate of temperature rise and fixed temperature operation. The detector shall automatically compensate for the thermal inertia of the detector.
 2. The rate of rise element shall be self-restoring, after activation.
 3. The fixed temperature unit shall be set at 135 degrees F (190 degrees F for high temperature areas, i.e. areas over 110 degrees F ambient).
 4. Provide a wire guard cover for the detector.
 5. Plug-in "twist-lock" detector connection to a fixed mounting/connection detector base.
 6. Detectors shall be suitable for wall (vertical) location or ceiling (horizontal) installation location.
- D. Fire Sprinkler Water Flow Detector.
1. Vane-type water flow detectors shall be provided on the sprinkler system piping. Detectors shall be designed for mounting on either vertical or horizontal piping, but shall not be installed in a pipe fitting and shall not be installed within 12 inches of any fitting or valve that changes or controls the direction of water flow.
 2. The detectors shall have a sensitivity setting to signal any flow of water that equals or exceeds the discharge from one or more sprinkler head(s).
 3. Detector switch mechanisms shall incorporate an instantly recycling pneumatic retard element with an adjustable range of 0 to 70 seconds. Switches shall have a minimum rated capacity of 7-amp 125-volt, AC .25-amp 24-volt D.C., a D.P.D.T. switch shall be actuated by a polyethylene vane extending into the

waterway of the piping. The device cover shall incorporate a tamper detection switch, to detect removal of the cover. Removal of cover shall activate the switch and activate a trouble alarm. The trouble alarm shall be a separate zone from the respective water flow alarm.

4. Detectors shall be of weatherproof, water resistant, dust tight, tamper resistant construction and shall provide a 0.75- inch conduit entrance. Detector shall be finished in red baked enamel finish.
 5. The water flow detector shall be suitable for "dry-pipe or wet-pipe" fire sprinkler systems shown in the Contract Documents. Where the fire sprinkler system is a "dry standpipe" system and for fire sprinkler systems employing automatic "on and off" fire sprinklers, the water flow sensor shall also include "high and low" air pressure sensors. Each sensor shall provide not less than two activation set points, to indicate water flow is occurring in the fire sprinkler system.
 6. Supervisory freeze monitoring, fire sprinkler water temperature supervisory sensor to detect potential water freeze condition in the standpipe, as part of the water flow detector installation location, monitored at the FACP. One supervisory signal to indicate a decrease in water temperature below 40 degrees F (4.4 degrees C) and a second supervisory signal to indicate restoration to above 40 degrees F.
- E. Fire Sprinkler Valve Tamper Switch
1. Tamper switch shall monitor the position of the fire sprinkler shut-off valves. Operation of the valve shall activate the switch and activate a trouble alarm. The valve supervisory trouble alarm shall be a separate zone from the respective water flow alarm and water flow trouble alarm.

2.05 EVACUATION ALARM DEVICES

- A. General
1. Evacuation alarm devices shall activate automatically from the control panel. Devices shall operate on a Class "A", 4-wire (Class "B", 2-wire) supervised alarm evacuation circuit. Series wired alarm devices shall not be used.
 2. Screw type terminals with numbered identification shall be provided for "in-out" connections of the alarm circuit wiring.
 3. Devices shall be installed in a metal box, 3.9-inch deep maximum, flush mounting unless indicated otherwise on the Drawings. Provide extension ring to increase the box depth, on the mounting box, if additional depth is required to accommodate the evacuation alarm device. Size as required for the audible alarm indicating device and wiring connections. Provide a trim ring and metal grill cover assembly. Cover assembly shall be a minimum of 0.062-inch-thick flat stainless steel or aluminum. Finish color of cover "red" unless selected otherwise by Owner's Representative. The word "FIRE" shall appear on the grill, minimum 0.5-inch high letters. The grill shall be screw attached to the box. The grill shall be square/rectangular shape for wall mounted evacuation devices and round for ceiling mounted evacuation alarm devices.
 4. A visual alarm indicating device shall be an integral part of the audible alarm box cover assembly, for wall mounted and ceiling mounted devices. Each audible evacuation alarm device shall incorporate an integral visual alarm indicator unless indicated otherwise on the Drawings.
 5. Alarm initiating devices, audible evacuation alarm device and visual evacuation alarm devices shall each be connected to separate circuits and conductors. Do not connect these devices to the same circuit conductors. The separate

audible evacuation circuits shall provide coded or non-coded audible signaling independent of the visual evacuation alarms.

6. The audio sound fire alarm evacuation system shall provide a sound intensity of not less than 20dBA above average ambient sound intensities, and 5dBA above maximum ambient sound intensity occurring for 60 seconds. Ambient sound intensities shall be measured after the Owner has occupied the building spaces. In no case shall the sound intensity of the evacuation devices be less than 90dBA or greater than 120dBA when measured 10-feet horizontally from the device.

B. Audible Evacuation Alarms

1. Vibrating horns:
 - a. Vibrating type horns shall be provided where audible devices are shown on the Drawings for the following areas: Building egress pathways, exterior of buildings, stairs, corridors, lobbies, reception areas, shops, exercise areas, areas exceeding 300 square feet, and all other areas not specifically listed or identified.
 - b. Horn shall be heavy duty electro-magnetic vibrating type. Horns shall have field adjustable sound output level control.
 - c. Horn shall provide a minimum sound level of 95dB at 10 feet centerline distance, when installed in the field operating conditions shown on the Drawings.
2. Mini horns:
 - a. Shall be used in rooms smaller than 300 square feet. Mini horns shall not be used as a substitute where vibrating horns are required.
 - b. Mini-horn shall be electric-piezo electronic.
 - c. Mini horn shall provide a minimum sound level of 87dB/90dBA at ten feet centerline distance, when installed in the field operating conditions shown on the Drawings.

C. Visual Evacuation Alarm Indicator

1. Lamp/Strobe internally illuminated projecting lens assembly, with flasher system. Unit shall flash on and off to provide visual indicating of fire alarm.
2. The word "FIRE" shall appear on the lens or lens plate. The lens shall project beyond the face of the cover assembly.
3. All visual evacuation alarm devices with a common evacuation alarm zone shall "flash" in full synchronized unison or in random pattern, software programmable from the fire alarm control panel. The synchronized visual evacuation alarm devices shall not "drift" out of synchronization at any time during operation.
4. The flash rate shall be software programmable from the fire alarm control panel for 1-3 flashes per second, with approximately 0.001 second flash duration.
5. Flash rate independent of audible device coded signal output.
6. Light source, Xenon high intensity flash strobe tube white/clear color, for Fire Alarm.
7. 75 candelas (cd) minimum, 180 candelas maximum flash intensity, at 10 feet distance along the direct line perpendicular axis viewing angle. The "Effective Intensity" of each flash shall not be less than 30 candelas from any viewing angle, but under any condition not less than required by AHJ. The flash intensity shall be "field" adjustable over the specified range.
8. Photosensitive induced epilepsy:
Wherever three or more multiple visual evacuation alarm devices are visible from any single location, the devices shall be adjusted to reduce the risk of

inducing photosensitive epilepsy seizure responses in susceptible people, using one or more of the following methods:

- a. Synchronizing the flash rate.
- b. Adjust the flash intensity.
- c. Adjust the physical location of the visual device.
- d. Devices installed closer than 55 feet distance "sight-line" together shall be synchronize flash rate.

2.06 REMOTE FIRE ALARM ANNUNCIATOR - RFAP

Reprogram the Existing RFAP to Fully Interface with the New Construction

PART 3 - EXECUTION

3.01 FIRE ALARM SYSTEM CONFIGURATION

- A. Fire Alarm System Survivability
 1. The fire alarm system equipment, wiring/cables, alarm initiation, alarm evacuation and zoning shall be configured, supplied and installed so a single point failure and/or fire damage condition does not contribute to the disruption of the operation of the entire fire alarm system. The undamaged portions of the fire alarm system will continue to operate during a fire.
 2. Separate and isolated routing paths through the building shall be provided for fire alarm circuits to avoid total loss of fire alarm system communications resulting from failure and/or fire damage, for both lateral/horizontal distribution communication paths on each floor and vertical riser communication paths in multi-story building.
 3. Quantities and arrangements of components contained in fire alarm equipment shall assure no single individual component failure will cause a failure of the equipment to provide the continued operation of the fire alarm system.

3.02 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

- A. General
 1. The inside cover of alarm initiating devices and communicating devices shall be marked with the zone initiating number communications identification address corresponding to the zone number in the respective control panel. Marking shall be with a felt-tip pen or permanent label.

3.03 TESTING AND COMMISSIONING (ADDITIONAL REQUIREMENTS)

- A. General
 1. The entire fire alarm system shall be tested after the installation and software programming is complete. Provide a Fire Alarm System Test Report of test results for review and approval.
 2. Individually activate each manual initiating station and verify correct alarm operation and control panel response, and remote equipment operation.
 3. Individually test each automatic initiating device and verify correct alarm operation, control panel response and remote equipment operation.
 4. The fire alarm system installation and operation shall be verified by the Manufacturer's Representative and a written Manufacturer's Verification Certificate delivered to the Owner's Representative.
 5. Individually operate each control function.
 6. Test the battery back-up systems by disconnecting the incoming normal power and allowing the alarm system to operate 72 hours on battery power. Sound

the alarm system for the specified reserve operation minutes at the end of 72 hours on battery power.

7. Fire Alarm Initiating Devices: Test and Verify each individual device with walk-around initiation, supervisory trouble test, and device missing test. Document each device type and address, physical location; activate/reset response time and sensitivity. Also activate each manual test button and automatic test sequence.
 - a. Activate each fire manual pullstation and pullstation cover with subsequent reset. For "break-glass" type, remove glass rods for test and then reinstall after completed.
 - b. Each fire smoke detector, activation test with UL listed aerosol "canned-smoke".
 - c. Each fire heat detector activation test with "heat-gun", heat rate-of-rise, and temperature set point.
 - d. Water flow, pressure sensor, fire suppression system and tamper, simulate activation alarm initiation. Do not cause actual discharge of fire sprinklers or discharge of fire suppression systems, as part of fire alarm system testing procedures.
8. Fire Alarm Evacuation Devices: When the fire alarm system evacuation alarms are initiated, confirm each evacuation device location functions correctly. Document each device type and address, physical location, sound level intensity (audibility and intelligibility) for audible devices in each room with and without devices, visual (direct and indirect) intensity for visual devices, and activate/reset response time:
 - a. Central Station monitoring notification and response occurs.
 - b. Security/Intrusion access control system notification and response occurs.
 - c. Emergency lighting control system notification and response occurs.
9. HVAC Interface: Confirm when the fire alarm system smoke detectors (area type and air duct type) activate, fire sprinkler water flow and/or fire alarm system activate alarm initiation:
 - a. Activate respective HVAC environmental air equipment shut down.
 - b. Activate respective HVAC fire/smoke dampers close.
 - c. Activate respective HVAC smoke controls. Document each device type and address, physical location, initiation and supervisory trouble, loss of power and device missing; activate/reset response time and sensitivity.

B. Documents and Performance

1. Perform all Electrical and Mechanical Tests required by the Equipment Manufacturer's Certification form. Measure and adjust each automatic detection detector to the maximum stable sensitivity setting. Detector tests shall be performed with the detector at its operational location and under normal operational environmental conditions in the area. Bench settings are not acceptable. An operational check-out test and report shall be performed. Submit six copies of test report results. The tests and report shall include, but not be limited to:
 - a. A complete list of equipment installed and wired.
 - b. Indication that all equipment is properly installed and functions and conforms with these Specifications.
 - c. Test of each individual zones as applicable.
 - d. Serial numbers, locations by zone and model number for each installed detector.

- e. Voltage (sensitivity) settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
 - f. Response time on thermostats and flame detectors (if used).
 - g. Technician's name, certificate number and date.
 - h. The completed manual and automatic monitoring and control system shall be tested to ensure that it is operating properly. This test will consist of exposing the installed units to a standard fire test.
- C. Acceptance Demonstration
- 1. Acceptance of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates continuously for a 90-day test period without any unwarranted alarms. In the event an unwarranted alarm(s) occurs, the Contractor shall repair, readjust, or replace the defective equipment and detector(s) with new equipment and begin another 90-day test period. The Contractor shall recheck the equipment and detectors using the fire test after each readjustment or replacement of equipment and/or detectors.
 - 2. Testing verification cycle shall be continuously repeated until the system successfully completes the testing. The test period shall not start until the Owner has obtained beneficial use of the building areas under tests.

3.04 WIRING (ADDITIONAL REQUIREMENTS)

- A. General
- 1. Review the total system point-to-point wiring and cable layout. Provide the correct quantities and types of wires, cables, outlets, and conduits/raceways to ensure the correct operation of the fire alarm system.
 - 2. Final connections, testing, adjusting, and calibration shall be made under the direct supervision of a Factory-Trained Technician of the System Supplier.
 - 3. All wiring and cables shall be in conduits/raceways. All conduits/raceways shall be installed and concealed in walls, above ceilings and in floors.
 - 4. All wiring and cables in cabinets shall be neatly formed and laced.
 - 5. Wiring shall be made up onto bolt and nut terminal blocks. Tag all spares. All wire conductors shall terminate on terminal strips with "spade" "eyebolt" type lugs, of adequate size for respective incoming and outgoing conductors. The terminal strips shall be labeled as to their use and wiring diagram shall be placed on/inside the equipment showing connections of all related equipment to these strips.
 - 6. Wiring Requirements for shielding certain conductors from other conductors or routing of fire alarm circuits in separate isolated raceways shall be as recommended by the Manufacturer's Documentation and AHJ.
 - 7. The fire alarm circuits, location, quantities of raceways, circuit conductors and devices shown on the Drawings are schematic. Provide all conduit, raceways, wiring, cables, devices, and conductors per Manufacturer's recommendations and as required by AHJ. Include all material and labor costs in the Contract price for compliance with providing a complete and operable fire alarm system.
 - 8. Wire and cable shall be type and size to insure installed circuit voltage drop and signal loss does not exceed Manufacturer's recommendations, but in no case shall the voltage drop and/or signal loss exceed the values permitted by the AHJ, including allowances for spare capacity/devices.
 - 9. Provide End of the Line (EOL) circuit termination device on each wiring circuit, for the trouble supervisory monitoring of each circuit by the fire alarm system.

10. All fire alarm raceways/conduit shall be installed concealed in public areas. All conductors and cables shall be installed in raceways/conduits.
 11. Conductors and Cable Types
 - a. Conductors, wiring, and cables used for fire alarm system circuits shall be Fire Marshal, California State Fire Marshal listed, AHJ and UL labeled and listed for fire alarm system applications. Isolated rated for 600 volts AC 60Hz.
 - b. Raceways/conduits for installation of fire alarm circuits shall be metal for all locations installed above earth/grade. Metal conduits shall be EMT, RGS or IMC type. FMC and LTFMC conduits shall not be permitted for fire alarm system circuits.
- B. Digital Multiplex Network Circuits
1. The conductors for digital, multiplex network and communication circuits shall be twisted insulated pairs, each twisted pair 100% metallic shielded, four twisted pair multi-conductor jacketed cable, with a separate 100% metallic shield enclosing all conductors under the jacket, #16 AWG copper conductors minimum with a separate internal ground/drain conductor.
 2. "Tees" and taps at any junction box location in the communication lines, shall be permitted by the system for connecting additional devices without affecting proper system operation.
- C. Conductors for Non-Digital Circuit
1. The minimum insulated conductor size for fire alarm non-digital evacuation alarm circuits, initiating circuits and control circuits shall be not less than #14AWG (600-volt THHN/THWN) copper.
 2. Conductors for evacuation alarm device circuits shall be insulated (600-volt THHN/THWN) stranded or solid copper conductors, quantity as recommended by Fire Alarm Manufacturer.

3.05 SPECIAL INSTALLATION REQUIREMENTS

- A. General
1. Whether or not shown on the Fire Alarm Drawings, the following systems shall be provided as part of the Contract. Provide fire alarm devices and connection of the systems to the fire alarm control panel including all material, labor, and cost in the Contract.
 2. Refer to HVAC, Mechanical, Plumbing, Fire Sprinkler and Architectural Drawings and Contract Documents for the location and quantity of these systems.
- B. Fire Sprinkler Water Flow Detection, Back Flow Preventer and Shut-Off Valve Tamper Switches:
1. Provide a Remote Equipment Monitoring and Control module (REMC) located at each fire sprinkler water flow detector, each back-flow preventer and each fire sprinkler water valve tamper switch, coordinate with Fire Sprinkler Installer.
 2. Provide fire sprinkler water flow switches, water pressure monitoring switch and supervisory freeze monitoring installed on each main fire sprinkler riser pipe and back flow preventer, coordinate with the Fire Sprinkler Installer.
 3. Provide fire sprinkler water valve tamper switches installed on each fire sprinkler system shut-off valve, coordinate with the Fire Sprinkler Installer.

4. Provide 0.75-inch conduit with 6#14 from the REMC to each fire sprinkler water flow switch, back flow preventer and each respective fire sprinkler water valve tamper switch.
 5. Provide connection of REMC to the fire alarm multiplex control system with 0.75-inch conduit and digital multiplex conductors.
- C. Area Protection Automatic Smoke Detectors and Heat Detectors
1. Area protection smoke detectors and heat detectors shall be ceiling mounted unless noted otherwise on the Drawings. Smoke detectors that are installed before final job site cleanup is complete by all trades shall be cleaned or replaced with new smoke detectors to match original smoke detectors.
 2. Provide detector quantities to ensure a minimum of one automatic detector for each 600 square feet of area, (and fraction thereof) for each building space where smoke detectors are required by the AHJ. In no case shall detector spacing exceed Manufacturer's or AHJ maximum recommendations/limits.
 3. Provide detector quantities to ensure the centerline to centerline spacing of installed detectors does not exceed Manufacturer's and AHJ's Requirements in the protected area.
 4. Locate area protection detectors a minimum of 48 inches horizontal distance from any air transfer grill/vent, air intake grill/vent and air discharge grill/vent.
 5. Provide connection of automatic initiating devices to the fire alarm multiplex control system with 0.75-inch conduit and digital multiplex communications conductors.

3.06 OUTLET BOXES (ADDITIONAL REQUIREMENTS)

- A. Device outlet boxes shall be flush mounted unless indicated otherwise on the Drawings. Provide extension rings to finish flush with finish surface. Where the Drawings indicate surface mounted devices, outlet boxes shall be cast metal with threaded hubs. Where the conduit entrances are not exposed for surface mounted devices, provide flush outlet box behind the device box, and omit the conduit hubs on the device box.
- B. Size device boxes and outlet boxes per Manufacturer recommendation and as required by Building Code for wire fill and construction.
- C. Outlet Boxes shall be listed, and Approved for Fire Alarm System use by AHJ and UL.

END OF SECTION 28 4600
101320/223099

SECTION 31 0000

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Materials, equipment, and labor required to provide grading and fine grading as indicated on Drawings and as specified.
 - 2. Work includes, but may not be limited to:
 - a. Excavation, compacted engineered fill, and preparing of subgrade for building footings, slabs, walks, and pavements.
 - b. Excavating and backfilling of trenches and excavations.
 - 3. Geotechnical Data reference and information.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition
 - 2. Section 01 4500: Quality Control; soil testing requirements
 - 3. Section 01 5000: Temporary Facilities and Controls; barriers and temporary controls.
 - 4. Section 01 5713: Temporary Erosion and Sedimentation Controls
 - 5. Section 32 1100: Base Course
 - 6. Section 32 1216: Asphalt Paving
 - 7. Section 32 1313: Concrete Paving
- C. Related Requirements:
 - 1. Excavating and Backfilling for Utility Work:
 - a. Refer to Division 26 Sections for excavation and backfill required for underground electrical utilities and related buried appurtenances.
 - b. Refer to Division 33 Sections for additional trenching and backfilling requirements for underground site utilities piping and related buried appurtenances.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, current edition of California Building Code (CBC), Part 2, Volumes 1 and 2.
- B. ASTM International (ASTM):
 - 1. ASTM D 1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
 - 2. ASTM D 2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 - 3. ASTM E 699 – Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
- C. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO – Standard Specifications for Highway Materials and Methods of Sampling and Testing.

- D. Public Works Standards, Inc.:
 - 1. Standard Specifications for Public Works Construction (SSPWC):
 - a. The "Greenbook"; current edition.
 - 2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 DEFINITIONS

- A. Excavation:
 - 1. Consists of removal of material encountered to subgrade elevations indicated and subsequent use of excavated material as fill, disposal off-site, or stockpiled for future use of materials removed.
- B. Unauthorized Excavation:
 - 1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect.
 - 2. Unauthorized excavation, as well as remedial work directed by Civil Engineer upon receipt of written authorization from Architect, will be at Contractor's expense.
 - 3. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
 - a. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Civil Engineer.
 - 4. In locations other than those above, backfill and compact unauthorized excavations as specified by Civil Engineer for authorized excavations of same classification, unless otherwise directed by Architect.
- C. Additional Excavation:
 - 1. When excavation has reached required subgrade elevations, notify Architect, who will notify Civil Engineer to make inspection of conditions.
 - 2. Should Civil Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material specified by Civil Engineer and directed by Architect.
 - 3. Contract sum may be adjusted by appropriate Contract modification.
 - 4. Removal of unsuitable material and its replacement as directed will be paid on basis of General Conditions of the Contract relative to changes in Work.
- D. Subgrade:
 - 1. Undisturbed earth or compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.

1.04 SUBMITTALS

- A. Test Reports:
 - 1. Submit following reports directly to Architect from testing services, with copy to Contractor:
 - 2. Test reports on borrow material.
 - 3. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
 - 4. Field Reports:
 - a. In-place soil density tests.

1.05 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
- B. Testing and Inspection Service:
 - 1. Owner will employ and pay for qualified independent geotechnical testing laboratory to perform soil testing and inspection service during earthwork operations.
- C. Testing Laboratory Qualifications:
 - 1. To qualify for acceptance, geotechnical testing laboratory must be Division of the State Architect (DSA) approved and demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has experience and capability to conduct required field and laboratory geotechnical testing without delaying progress of Work.
- D. Foundation Soils:
 - 1. Excavate for foundations to sizes indicated, clean and leave in condition recommended by Civil Engineer.
 - 2. Prior to placement of forms, reinforcing or concrete, obtain approval of Civil Engineer and DSA Project Inspector as required, for proper conditions and suitable bearing materials.
 - 3.

1.06 PROJECT CONDITIONS

- A. Noise and Dust Abatement:
 - 1. Exercise reasonable and necessary means to abate dust, dirt rising and undue noise.
 - a. Perform necessary sprinkling and wetting of construction site to allay dust.
- B. Existing Utilities:
 - 1. Locate existing underground utilities in areas of excavation work.
 - 2. Where utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
 - 3. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for direction.
 - 4. Cooperate with Owner and utility companies in keeping respective services and facilities in operation.
 - a. Repair damaged utilities to satisfaction of utility owner.
 - 5. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.
 - a. Provide minimum of forty-eight hour notice to Architect and Owner and receive written notice to proceed before interrupting utility.
 - 6. Demolish and completely remove from Project Site existing underground utilities indicated to be removed.
 - a. Perform backfilling for abandoned underground utilities conforming to Articles 2.01 – Soil Materials and 3.05 – Backfill and Fill of SSPWC.
 - b. Coordinate with utility companies for shutoff of service if lines are active.

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- C. Protection of Subgrade:
 - 1. Do not allow equipment to pump, rut or disturb subgrade, stripped areas, or other areas prepared for backfill or paving operations.

1.07 GEOTECHNICAL INVESTIGATION DATA

- A. Soil, geologic, and seismic investigations were conducted at Project Site, and results are to be found in following report:
 - 1. Report No. SF-3375-06, dated March 5, 2020
 - 2. Report: Geotechnical Engineering Update Report
Fullerton College Sherbeck Field Improvement
Fullerton, California
Prepared for North Orange County Community College District
- B. Report Prepared By: Geotechnical Solutions, Inc..
27 Mauchly, Suite 210
Irvine, CA 926183
(T) 949.453.0406
- C. Geotechnical investigation data is not part of Contract Documents, but is made available by Owner as "Information Available to Bidders".
 - 1. Bidders are strongly urged to examine entire geotechnical investigation data and make their own examination of Site prior to bidding.
 - 2. Bidders must make their own determination of conditions which affect performance of Work.
- D. Report data on indicated subsurface conditions is not intended as representations or warranties of accuracy or continuity between soil borings.
 - 1. It is expressly understood that Owner, Architect, and Geotechnical Consultant will not be responsible for interpretations or conclusions drawn therefrom by Bidder.
 - 2. Owner, Architect, and Geotechnical Consultant further disclaim responsibility for interpretation of data by bidders, as in projecting soil-bearing values, rock profiles, soil stability and presence, level and extent of underground water.
- E. Additional Test Borings and Other Exploratory Operations:
 - 1. Prior to bidding, bidders may request permission to make their own subsurface investigations to satisfy themselves as to site and subsurface conditions at no cost to Owner.
 - a. Such investigations may be performed only under time schedules and arrangements approved in advance by Owner and Architect.
 - 2. Upon completion of additional exploratory work, restore Site as directed by Owner.
 - a. Backfill test holes and pits using removed material.
 - b. When removed material is not sufficient, provide additional compatible material of similar character to native soil.
 - c. Compact backfill to same density as adjacent soil.
 - 3. Contractor shall be fully responsible for deductions or conclusions made on basis of information or data collected from additional exploratory work.
- F. Project Geotechnical Engineer will be retained by Owner to observe performance of Work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction tests.

- G. Readjust Work performed that does not meet technical or design requirements, but make no deviation from Contract Documents without specific and written approval from Architect.
- H. In addition to complying with requirements of governmental agencies having jurisdiction, comply with directives of Project Geotechnical Engineer at Project Site during earthwork operations.
 - 1. Notify Architect of discrepancies in specifications and actual site conditions, or of discrepancies between Project Geotechnical Engineer's directives and Contract Documents.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

- A. Imported Soil Materials:
 - 1. Fill soil imported to Project Site:
 - a. Granular, with expansion index of less than twenty.
 - b. Classified as SM, SW, and SP in accordance with ASTM D 2487.
 - 2. Import Fill:
 - a. Free of rock and lumps of soil larger than three inches in diameter.
 - b. Be at least sixty percent finer than 1/4 inch sieve.
- B. Utility Trench Backfill:
 - 1. Provide material for use in backfilling trenches consisting of hard, durable, clean sand, gravel, or crushed stone.
 - a. Free from organic material, clay balls, or other deleterious substances.
- C. Base Material:
 - 1. Provide base material under asphalt pavements classified as Class II Aggregate Base as specified in Section 32 1100, or Section 26-1, 02B of SSPWC.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Excavation Classifications:
 - 1. Following classifications of excavation will be made when rock is encountered:
 - a. Earth excavation includes excavation of pavements and other obstructions visible on surface, including but not necessarily limited to:
 - 1) underground structures and utilities
 - 2) Other items indicated to be demolished and removed.
 - a) Along with with earth and other materials encountered that are not classified as rock or unauthorized excavation.

3.02 STABILITY OF EXCAVATIONS

- A. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
 - 1. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.03 STORAGE OF EXCAVATED MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill where directed.
 1. Place, grade and shape stockpiles for proper drainage.
 2. Locate and retain soil materials horizontally away from edge of excavations equal to depth of excavation.
 3. Do not store within drip line of trees indicated to remain.
 4. Dispose of excess excavated soil materials not acceptable for use as backfill or fill.

3.04 TRENCH EXCAVATION FOR PIPES AND CONDUIT

- A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and minimum of six to nine inches of clearance on both sides of pipe or conduit.
- B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil.
 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 2. Where rock is encountered, carry excavation six inches below required elevation and backfill with six inch layer of crushed stone or gravel prior to installation of pipe.
 3. For pipes or conduit less than six inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths.
 - a. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
 4. For pipes and equipment six inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for ninety degrees (bottom 1/4 of circumference).
 - a. Fill depressions with tamped sand backfill.
 - b. At each pipe joint, dig bell holes to relieve pipe bell of loads to ensure continuous bearing of pipe barrel on bearing surface.

3.05 BACKFILL AND FILL

- A. Fill Material and Backfill Material:
 1. Consisting of satisfactory soil material or imported soil materials as specified in Part 2 of this section.
 - a. Place in maximum six inch thick compacted layers to required subgrade elevations, except as follows:
 - 1) Under Walks:
 - a) Upper four inches of fill shall consist of sub-base as defined in Article 2.01 C 1, or base material as defined in Section 32 1100.
 - 2) Under Interior Building Slabs:
 - a) Upper four inches of fill shall consist of compactable sand or rock as specified in Article 2.01A.
 - b. Under Piping and Conduit and Equipment:
 - 1) Use sub-base materials where required over rock bearing surface and for correction of unauthorized excavation.

- 2) Shape excavation bottom to fit bottom ninety degrees of cylinder.
- c. Backfill trenches with concrete where trench excavations pass within eighteen inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings.
 - 1) Place concrete to level of bottom of adjacent footing.
 - 2) Concrete is specified in Section 03300.
 - 3) Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Architect.
 - 4) Use care in backfilling to avoid damage or displacement of pipe systems.
- B. Backfill excavations as promptly as Work permits, but not until completion of following:
 - 1. Acceptance of construction below finish grade.
 - 2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
 - 3. Removal of:
 - a. Concrete formwork.
 - b. Shoring and bracing, and backfilling of voids with satisfactory materials.
 - c. Trash and debris from excavation.
 - 4. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.06 PLACEMENT AND COMPACTION

- A. Ground Surface Preparation:
 - 1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills.
 - 2. Plow strip or break up sloped surfaces steeper than one vertical to four horizontal (1:4) so that fill material will bond with existing surface.
 - 3. When existing ground surface has density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content or slightly above, and compact to required depth and percentage of maximum density.
 - 4. Where unsuitable material described above, is greater than twelve inches thick, material will have to be removed and recompacted as directed by Civil Engineer.
- B. Place backfill and fill materials in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers.
- C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content or slightly above.
 - 1. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.
- D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations.
 - 1. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

- E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below.
 - 1. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.
 - 2. Percentage of Maximum Density Requirements:
 - a. Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:
 - b. Under Foundations, Building Slabs and Steps:
 - 1) Compact top eighteen inches of subgrade and each layer of backfill or fill material at ninety percent maximum density.
 - c. Under Pavements:
 - 1) Compact top twelve inches of subgrade and each layer of backfill or fill material at ninety percent maximum density.
 - d. Under Lawn or Unpaved Areas:
 - 1) Compact top six inches of subgrade and each layer of backfill or fill material at eighty percent maximum density.
 - e. Under Walkways:
 - 1) Compact top twelve inches of subgrade and each layer of backfill or fill material at ninety percent maximum density.
 - 3. Moisture Control, under direction of Civil Engineer:
 - a. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material.
 - b. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - c. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 - d. Stockpile or spread soil material that has been removed because it is too wet to permit compaction.
 - e. Assist drying by disking, harrowing or pulverizing until moisture content is reduced to satisfactory value.

3.07 GRADING

- A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas.
 - 1. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
- B. Grading Outside Building Lines:
 - 1. Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
 - 2. Finish surfaces free from irregular surface changes and as follows:
 - a. Lawn or Unpaved Areas:
 - 1) Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
 - b. Walks:
 - 1) Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.

- c. Pavements:
 - 1) Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

3.08 EROSION CONTROL

- A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.
 - 1. Comply with additional requirements specified in Section 01 5713,

3.09 MAINTENANCE

- A. Protection of Graded Areas:
 - 1. Protect newly graded areas from traffic and erosion and keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas:
 - 1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's Property:
 - 1. Remove waste materials, including unacceptable excavated material, trash, and debris, and legally dispose of it off Project Site.
 - 2. Comply with requirements specified in Section 01 7419.

END OF SECTION 31 0000

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SECTION 31 1000

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Removal of organic materials, including but not necessarily limited to:
 - a. Vegetation such as:
 - 1) Grass and grass roots.
 - 2) Shrubs
 - 3) Trees, tree roots, tree stumps, and upturned stumps.
 - 4) Weed growth.
 - 5) Brush.
 - b. Additional items not included elsewhere, such as:
 - 1) Rubbish, debris, and other objectionable materials, within limits of Work.
 - c. Provide dust control measures.
 - 1) As required by authorities having jurisdiction.
 - 2. Conform to work restrictions for archaeology, endangered species, and hazardous materials, when required.
 - a. Provide dust control measures conforming to requirements of Section 01 5000.
 - 3. Protection of existing materials to remain.
 - a. Includes tree protection fences.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 01 5000: Temporary Facilities and Controls; barriers and temporary controls.
 - 3. Section 01 5713: Temporary Erosion and Sedimentation Controls; maintenance of controls during site clearing operations.
 - 4. Section 31 0000: Earthwork
- C. Related Requirements:
 - 1. Refer to Division 32 Landscaping Sections for additional requirements.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
- B. ASTM International (ASTM):
 - 1. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- C. Public Works Standards, Inc.:
 - 1. Standard Specifications for Public Works Construction (SSPWC):
 - a. The "Greenbook"; current edition.
 - 2. Standard Plans for Public Works Construction (SPPWC); current edition..

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. When requested, provide site plan indicating extent of site clearing.

1.04 QUALITY ASSURANCE

- A. Comply with SSPWC "Greenbook" as minimum requirement.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 TREE AND PLANT PROTECTION – GENERAL

- A. Preserve and protect existing trees and plants at Project Site that are designated to remain, and those adjacent to Project Site.
 - 1. Perform clearing without damage to undergrowth, and ground surfaces which occur outside of areas indicated to be cleared as indicated on Drawings and are to remain undisturbed.
- B. Protect individual trees which lie within areas to be cleared, which are banded and identified to remain, from damage.
 - 1. Provide temporary barriers around each, or around each group of trees or plants.
- C. Trenching Near Trees:
 - 1. Where utility trenches are required near trees, excavate under or around tree roots by hand or with air spade.
 - 2. Do not cut main lateral tree roots or taproots.
 - a. Cut only smaller roots that interfere with installation of utilities.
 - b. Do not allow exposed roots to dry out before placing permanent backfill.
- D. Damaged Trees:
 - 1. Existing trees or permanent planting indicated to remain that are damaged or destroyed by construction operations or storage of material or equipment are to be trimmed and reshaped by tree surgeons, or replaced, each at Contractor's expense and as directed by Architect.
 - 2. Perform trimming and reshaping to satisfaction of Architect/Landscape Architect.
 - 3. Species and size for replacement trees and plantings will be selected by Architect/Landscape Architect.

3.02 TRIMMING OF EXISTING TREES TO REMAIN

- A. Trim roots of trees where uncovered, making clean cuts.
 - 1. Cover cut roots with 4 inches of soil
- B. Prevent damage to tree limbs which project within work areas.
 - 1. Trim or cut only with specific prior approval of Architect or Landscape Architect.
 - 2. Remove dead branches and shape living branches as directed by Landscape Architect.
 - a. Make flush cuts leaving no stubs

- b. Cut back to living tissue where necessary, smooth and shape surfaces to shed water.
- C. Apply tree wound paint on cut surfaces 1 inch diameter and larger when directed by Landscape Architect.

3.03 TREE PROTECTION FENCES

- A. Fence Locations:
 - 1. Provide and maintain following:
 - a. Tree protection fences around individual trees and groups of trees which are to remain in place.
 - b. Intermittent or continuous tree protection fences, in general, along "Limit of Work" lines indicated.
 - 2. Locate tree protection fences at outer limit of branch spread of protected trees
- B. Fence Construction:
 - 1. Materials:
 - a. Lumber:
 - 1) Sound, clean material, new or used, in good condition.
 - b. Fence Posts:
 - 1) 4 inches x 4 inches x 7 feet – 0 inch minimum length
 - c. Fence Rails:
 - d. 1 inch x 8 inches square edge stock x lengths to suit post spacings.
 - 2. Set posts 3 feet – 0 inches into ground, spaced at maximum of 10 feet – 0 inches on center, unless indicated otherwise.
 - a. Set one rail along top front face of posts
 - b. nail rails securely to each post
 - 3. Maintain fences as required, including replacing damaged or destroyed portions, throughout entire period of Work.
 - 4. Fences are to be removed upon completion of Work, or when directed by Architect
 - 5. Upon removal of fences, backfill post holes to grade and remove fence material from Project Site.

3.04 CLEARING AND GRUBBING

- A. Clearing:
 - 1. Cut trees and undergrowth within cleared areas as indicated.
 - 2. Confine equipment and operations to areas to be cleared
 - 3. Fell trees only into areas to be cleared
 - 4. Cut tree stumps and undergrowth roots flush with existing ground surface outside of construction areas and paved areas.
 - a. Where indicated, completely remove tree stumps as specified.
- B. Grubbing:
 - 1. Grub in cleared areas required to perform construction work
 - 2. Perform grubbing to completely remove stumps, roots, and organic materials

3.05 TREE AND STUMP REMOVAL

- A. Remove trees and stumps indicated or required to be removed.

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1. Remove trees, together with bulk of roots, to minimum depth of 4 feet below required grade, and within radius of approximately 7 feet beyond perimeter of trunk at grade.
- B. Fill and compact excavation from tree and stump removal.
 1. Fill in 6 inch layers, each compacted to 90 percent of maximum density in accordance with ASTM D 1557.
 2. Do not commence back filling until excavation is inspected and tested.

3.06 REMOVAL OF TOPSOIL

- A. When required, perform removal of topsoil in accordance with requirements as indicated on Drawings..

3.07 TRIMMING OF EXISTING TREES TO REMAIN

- A. Trim roots of trees where uncovered, making clean cuts.
 1. Cover cut roots with 4 inches of soil
- B. Prevent damage to tree limbs which project within work areas.
 1. Trim or cut only with specific prior approval of Architect or Landscape Architect.
 2. Remove dead branches and shape living branches as directed by Landscape Architect.
 - a. Make flush cuts leaving no stubs
 - b. Cut back to living tissue where necessary, smooth and shape surfaces to shed water.
- C. Apply tree wound paint on cut surfaces 1 inch diameter and larger when directed by Landscape Architect.

3.08 CLEANUP

- A. Material Disposal:
 1. Remove cleared and grubbed materials, rubbish, debris, and other waste materials and legally dispose of them off Project Site.
- B. Chipping:
 1. Chipping of tree materials and disposal by distribution or dispersal on Project Site:
 - a. May be permitted, where and in manner as directed, subject to available space on-site.
 2. Chipping of tree materials is permitted, however, disposal by distribution or dispersal is not permitted on Project Site.
 - a. Remove chipping materials and legally dispose of them off Project Site.

END OF SECTION 31 1000

SECTION 32 0523

CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Portland cement concrete for miscellaneous site concrete items, including, but not necessarily limited to:
 - a. Concrete footings for:
 - 1) Exterior signage posts.
 - 2. Cast-in-Place Concrete for:
 - a. Mow curbs
 - b. Underground pipe and conduit bedding, encasements, thrust blocks, and similar structures.
 - c. Yard and valve boxes.
 - d. Vaults, and similar structures.
 - 3. Precast Concrete for:
 - a. Splash Blocks
- B. Related Sections:
 - 1. Section 01 4100: Regularory Requirements; current Code edition.
 - 2. Section 01 5000: Temporary Facilities and Controls; for traffic control and project protection.
 - 3. Section 07 6200: Sheet Metal Flashing and Trim; downspouts,
 - 4. Section 31 0000: Earthwork; excavation, backfilling, and grading requirements.
 - 5. Section 32 1313: Concrete Paving.

1.02 REFERENCES

- A. California Code of Regulations, Title 24, California Building Code (CBC), Part 2, Volumes 1 and 2, current edition.
- B. ASTM International (ASTM):
 - 1. ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. ASTM A 1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 3. ASTM C 33 – Standard Specification for Concrete Aggregates
 - 4. ASTM C 94 – Standard Specification for Ready-Mixed Concrete
 - 5. ASTM C150 – Standard Specification for Portland Cement
- C. American Concrete Institute (ACI):
 - 1. ACI 301 – Specification for Structural Concrete for Buildings.
 - 2. ACI 304 – Recommended Practice for Measuring, Mixing and Placing Concrete.
 - 3. ACI 347R – Guide to Formwork for Concrete.

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- D. Concrete Reinforcing Steel Institute (CRSI):
 - 1. Manual of Standard Practice.
 - 2. Recommended Practice for Placing Reinforcing Bars.
- E. West Coast Lumber Inspection Bureau (WCLIB):
 - 1. Standard Grading Rules No. 17, current edition.
- F. Public Works Standards, Inc.:
 - 1. Standard Specifications for Public Works Construction (SSPWC):
 - a. The "Greenbook"; current edition.
 - 2. Standard Plans for Public Works Construction (SPPWC); current edition

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Plans, elevations and details of Site Concrete Work.
- B. Product Data:
 - 1. Mix designs and manufacturer's technical data for materials and products.
- C. Material Sample:
 - 1. One concrete bumper to Project Inspector for destructive testing.

1.04 QUALITY ASSURANCE

- A. Comply with pertinent sections of SSPWC and following:
 - 1. Formwork and Accessories:
 - a. Design Criteria:
 - 1) Formwork conforming to ACI 347R.
- B. Reinforcing:
 - 1. Welders' Qualifications:
 - a. Qualify welders in accordance with AWS D1.4 and AWS D1.
- C. Concrete:
 - 1. Requirements of ACI 301 govern Work, materials, and equipment related to this Section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Formwork and Accessories:
 - 1. Forming Materials:
 - a. Comply with requirements as specified and following:
 - 1) Wood Framing:
 - a) WCLIB standard grade or better Douglas Fir.
 - 2) Side Forms:
 - a) Douglas Fir, Construction Grade or Better or metal forms.
 - 3) Stakes:
 - a) Douglas Fir, Construction Grade or Better, or metal stakes.

- B. Reinforcing:
 - 1. Bars:
 - a. New billet steel:
 - 1) Conforming to ASTM A 615 Grade 60.
 - 2) Conforming to ASTM A 706, Grade 60, where welded.
 - 2. Tie Wires and Spirals:
 - a. Conforming to ASTM A 1064.
 - 3. Bar Supports:
 - a. As required for assembling and supporting reinforcement in place.
- C. Concrete and Related Materials:
 - 1. Comply with applicable provisions of SSPWC, Section 201 - Concrete, Mortar, and Related Materials:
 - a. Concrete:
 - 1) Ready-mixed concrete meeting requirements of ASTM C 94.
 - a) Provide 28 day compressive strength, minimum 3,000 psi, unless specified otherwise.
 - b) Cement: Conforming to ASTM C150, Type II / V, low alkali.
 - 2) Aggregates:
 - a) Coarse Aggregate: Conforming to ASTM C 33, consisting of clean, hard, fine grained, sound crushed rock, or washed gravel, or combination of both.
 - b) Fines: Conforming to ASTM C 33, consisting of sand equivalent not less than 75 when tested per ASTM D 2419.
 - 2. Concrete Admixtures:
 - a. Use of calcium chloride or admixtures containing calcium chloride is prohibited.
- D. Expansion Joint Filler:
 - 1. Preformed expansion joint filler, bituminous type, complying with ASTM D 994.

2.02 SPLASH BLOCKS

- A. Reinforced, precast concrete, of size, profile, and thickness shown on Drawings.
 - 1. Design Mix:
 - a. 2 parts concrete sand, and 1 part cement.
 - b. Limit water content to make mix stiff.
 - 2. Course Aggregate:
 - a. Carefully graded and washed gravel or stone.
 - 1) Conforming to ASTM C 33
 - b. Mix gravel not to exceed 3/8 inch.
 - c. Gradation may vary to achieve desired finish and texture.
 - 3. Fine Aggregate:
 - a. Carefully graded and washed natural concrete sand
 - 1) Conforming to ASTM C 33.
 - b. Gradation may vary to achieve desired finish and texture.
 - 4. Water:
 - a. Potable water free from impurities.
 - 5. Admixtures:
 - a. When required.
 - b. Conforming to ASTM C 494.

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6. Reinforcing Steel:
 - a. Conforming to ASTM A 615.
 - b. No.4, Grade 60 rebar, and 1/4 inch HR round steel.
7. Strength:
 - a. Comprehensive strength of 4,000 to 6,000 psi at 28 days depending on mixture and additives, as determined by tests of 6 inch cylinders.
8. Weight: 49 lbs.
9. Color:
 - a. Manufacturer's standard Gray.
10. Manufacturer:
Modern Precast, Inc., Salt Lake City, UT, or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas where formwork will be constructed and verify that:
 1. Excavations are sufficient to permit placement, inspection and removal of forms.
 2. Excavations for earth forms have been neatly and accurately cut.
 3. Conditions are otherwise proper for formwork construction

3.02 PREPARATION

- A. Obtain necessary information for coordination of formwork with items to be embedded in concrete and other related work.

3.03 INSTALLATION OF FORMWORK AND REINFORCING

- A. Miscellaneous Exposed Concrete:
 1. Install yard boxes, vaults, and similar structures, in compliance with SSPWC, Section 303.
- B. Underground conduit bedding, encasements, thrust blocks, and similar structures may be placed directly in excavations conforming to required sizes.
- C. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb Work in finished structures.
 1. Maintain formwork construction tolerances complying with ACI 347.
- D. Reinforcing Installation:
 1. Comply with applicable provisions of SSPWC, Section 303.

3.04 PLACING

- A. Notify Project Inspector at least 48 hours before placing concrete.
- B. Perform concrete placement, surface finishes, curing, and removal of forms in compliance with applicable provisions of SSPWC, Section 303.

3.05 FORM REMOVAL

- A. Remove forms carefully to avoid damaging concrete, including corners and edges of exposed concrete.
 - 1. Do not remove formwork prior to concrete member attaining specified strength:

3.06 SPLASH BLOCK INSTALLATION

- A. Provide splash blocks in locations indicated on Drawings.
 - 1. Coordinate placement with location of downspouts.

3.07 CLEANING

- A. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.

3.08 PROTECTION

- A. Protect Work until Substantial Completion.

END OF SECTION 32 0523

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SECTION 32 1100

BASE COURSE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Furnishing and installing base course material under paving.
- B. Related Sections:
 - 1. Section 32 1216: Asphalt Paving
 - 2. Section 32 1313: Concrete Paving

1.02 REFERENCES

- A. State of California Department of Transportation (Caltrans):
 - 1. Standard Specifications:
 - a. Division IV – Subbases and Bases
 - 1) Section 26 – Aggregate Bases.
- B. Public Works Standards, Inc.:
 - 1. Standard Specifications for Public Works Construction (SSPWC):
 - a. The "Greenbook"; current edition.
 - 2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 DEFINITIONS

- A. Caltrans Class 2 Base:
 - 1. Comply with Section 26-1.02B of Caltrans Standard Specifications, current edition
 - a. Aggregate Gradation:
 - 1) Conforming within percentage passing limits for sieve sizes shown in Aggregate Gradation Table.
 - b. Aggregate Quality Characteristics:
 - 1) Complying with requirements shown in Aggregate Quality Characteristics Table
- B. Crushed Aggregate Base:
 - 1. Consisting entirely of crushed rock and rock dust.
 - a. Conforming to requirements of SSPWC Sections 200-1.1 and 200-1.2

1.04 SUBMITTALS

- A. Product Data:
 - 1. Include material source, technical information, and test data for base materials.
 - 2. Gradation and quality certifications: Dated within 30 days of submittal.
- B. Samples:
 - 1. Minimum 5 pound container of proposed base course material.

1.05 QUALITY ASSURANCE

- A. Comply with Caltrans Standard Specifications or SSPWC as minimum requirement, except where indicated otherwise.

PART 2 PRODUCTS

2.01 BASE COURSE MATERIALS

- A. Caltrans Class 2 Base: :
 - 1. Conforming to Caltrans Class 2 as defined in Article 1.05 B.
- B. Crushed Aggregate Base:
 - 1. Conforming to requirements of SSPWC as defined in Article 1.05 A.

2.02 MATERIAL APPROVAL

- A. Provide Base material as inspected by Project Inspector prior to installation.
 - 1. Owner may choose to have additional tests performed by geotechnical engineer, retained by Owner before installation.

PART 3 EXECUTION

3.01 BASE COURSE INSTALLATION

- A. Install base course material in layers not exceeding 3 inches in thickness, unless otherwise required.
 - 1. Grade and compact to indicated levels or grades
 - a. Cut and fill.
 - b. Water and roll until surface is hard and true to line, grade and required section.
 - c. Provide relative compaction of at least 95 percent, unless otherwise required.
 - 2. Grade base course to elevations indicated on Drawings, ready to receive specified surfacing.

3.02 CLEANING

- A. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.

3.03 PROTECTION

- A. Protect Work until Substantial Completion.

END OF SECTION 32 1100

SECTION 32 1216

ASPHALT PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Material and installation for following:
 - a. Asphalt (bituminous) surfacing.
 - 1) Single course bituminous paving.
 - b. Seal coat for asphalt surfacing
- B. Related Sections:
 - 1. Section 01 5000: Temporary Facilities and Controls; barriers and temporary controls
 - 2. Section 01 5713: Temporary Erosion and Sediment Controls
 - 3. Section 31 0000: Earthwork; compacted subgrade for paving.
 - 4. Section 32 1100: Base Course
 - 5. Section 32 1313: Concrete Paving
 - 6. Section 32 1723: Pavement Markings; accessible path of travel.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM D 946 – Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
 - 2. ASTM D 1188 – Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO Standard Specifications for Highway Materials and Methods of Sampling and Testing.
- C. The Asphalt Institute (AI):
 - 1. AI MS-2 – Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; current edition.
 - 2. AI MS-19 – A Basic Asphalt Emulsion Manual; current edition.
- D. Public Works Standards, Inc.:
 - 1. Standard Specifications for Public Works Construction (SSPWC):
 - a. The "Greenbook"; current edition.
 - 2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Base Materials:
 - a. Refer to base course materials specified in Section 32 1100.
 - 2. Herbicide Treatment:
 - a. Manufacturer's technical data for products proposed for use.
 - b. Certificate indicating compliance with EPA requirements.

3. Bituminous Materials:
 - a. Manufacturer's technical data for materials and products
 - b. Site plan indicating extent of paving and accessories.
 4. Seal Coat:
 - a. Manufacturer's product information and application procedures for seal coating.
- B. Weighmaster Certificates:
1. Furnish licensed weighmaster certificates with each load of asphalt (bituminous) surfacing delivered to Project.
 2. Yield of Asphalt Material:
 - a. 24 pounds per square foot of paving area based on 2 inch thickness after rolling.
 - b. 5 percent tolerance will be allowed between total calculated weight and actual weight incorporated in Work.
 3. Deliver certificates to Owner's representative, who will collect certificates and ensure that material represented by each certificate is actually incorporated in Work.

1.04 QUALITY ASSURANCE

- A. Comply with SSPWC as minimum requirement asphalt (bituminous) surfacing materials and installation.
- B. Pre-Construction Conference: Prior to installation of engineered paving mat, arrange meeting at Project Site with manufacturer's representative and paving mat installer.
1. Notify Architect and Project Inspector of meeting minimum of 7 days in advance of time of meeting, or as specified in Section 01 3119.
 2. Provide copy of manufacturer's specifications Project Inspector at meeting
 3. Arrange for manufacturer's representative to be present, at minimum, for first day of installation of engineered paving mat and available thereafter upon request by Architect or installer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Sealer Material:
1. Agitate bulk materials during transport.
- B. Store engineered paving mat per manufacturer's recommendations in dry covered condition free from dust, dirt, and moisture.

1.06 PROJECT CONDITIONS

- A. Information on Drawings does not constitute guarantee of accuracy or uniformity of soil conditions over Project Site.
- B. Grade Control:
1. Establish and maintain required lines and elevations.
- C. Field Conditions for Asphalt (Bituminous) Surfacing Placement:
1. Place bitumen mixture when temperature is not more than 15 degrees F below bitumen supplier's bill of lading and not more than maximum specified temperature.

2. Do not place asphalt (bituminous) surfacing when atmospheric temperature is below 40 degrees F, or during unsuitable weather.

1.07 MAINTENANCE

- A. Extra Material:
 1. Furnish 10 gallons of sealer material in unopened containers.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Headers and Stakes:
 1. Headers:
 - a. "Construction Heart" Grade redwood as graded by Redwood Inspection Service.
 - b. Size: 2 x 6, unless otherwise indicated.
 2. Stakes:
 - a. 2 x 4 redwood or 2 x 3 Douglas Fir, Construction Grade.
 3. Nails:
 - a. Common, galvanized, 12d minimum.
- B. Herbicide Treatment:
 1. Commercial chemical for weed control, registered by Environmental Protection Agency (EPA).
 2. Provide granular, liquid, or wettable powder form.
 3. Manufacturers:
 - a. Subject to compliance with specified requirements, provide products of one of following:
 - 1) Bayer
 - 2) Dow AgroSciences
 - 3) E.I. Du Pont du Nemours and Company
 - 4) FMC Corporation
 - 5) Monsanto Company
 - 6) U.S. Borax & Chemical Corporation.
- C. Base Course:
 1. Refer to Section 32 1100.
- D. Miscellaneous Materials:
 1. Aggregate for Binder Course:
 - a. In accordance with Caltrans specifications for Grade PG 64-10 Binder.
 2. Aggregate for Wearing Course:
 - a. In accordance with Caltrans or SSPWC specifications.
 3. Fine Aggregate:
 - a. In accordance with Caltrans or SSPWC specifications.
 4. Mineral Filler:
 - a. Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
 - 1) Conforming to Caltrans or SSPWC specifications.
 5. Primer:
 - a. In accordance with SSPWC 203-2.4.

- 6. Tack Coat:
 - a. In accordance with SSPWC specifications.
- E. Bituminous Surface Course:
 - 1. Vehicle Traffic:
 - a. Provide materials of class, grade, or type indicated, conforming to SSPWC, Section 203-6.4 – Asphalt Concrete Mixtures.
 - 1) Class and Grade: C2-PG 64-10 per SSPWC Section 203-6.4.1
- F. Seal Coat:
 - 1. Provide seal coat materials conforming to SSPWC Section 203-9 by one of following or approved equal:
 - a. Guard-Top, Division of Western Emulsions Inc.
 - b. OverKote by Diversified Asphalt Products
 - c. Park Top by Western Colloid Products

2.02 MIX DESIGNS FOR ASPHALT (BITUMINOUS) SURFACING

- A. Design mixes conforming to Caltrans standards or SSPWC specifications.
- B. Submit proposed mix design of each class of mix for review prior to beginning of Work.

2.03 SOURCE QUALITY CONTROL

- A. Obtain materials from same source throughout Project.
- B. Test mix design and samples in accordance with AI MS-2.

2.04 PERFORMANCE REQUIREMENTS

- A. Design asphalt paving section and aggregate base course, as designated in Geotechnical Report.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE INSTALLATION

- A. Refer to Section 32 1100

3.03 HEADER INSTALLATION

- A. Install headers along edge of asphalt (bituminous) surfacing abutting turf, earth, or planting area, unless indicated otherwise.
- B. Install headers so bottom surface has continuous bearing on solid grade.
 - 1. Where excavation for headers is undercut, thoroughly tamp soil under header.

2. Compact backfill on both sides of header to density of adjacent undisturbed earth.
- C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade minimum of 12 inches.
 1. Provide stakes of sound material, neatly pointed, driven vertically, and securely nailed to headers.
 - a. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header.
 - b. Provide minimum of 2-12d galvanized common nails through each stake.
- D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.
- E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.
- F. Provide additional stakes and anchorage as required to fasten headers in place.

3.04 PREPARATION

- A. Primer: Apply primer in accordance with Greenbook Section 302-5.3.
- B. Tack Coat:
 1. Apply tack coat in accordance with Caltrans Specifications Section 39 and following:
 - a. Apply tack coat to asphalt concrete base course or sand asphalt base course.
 - b. Apply emulsified asphalt tack coat between each lift or layer of full depth asphalt concrete and sand asphalt bases and on surface of bases where asphalt paving will be constructed.
 - c. Apply tack coat to surfaces of previously constructed asphalt concrete base courses or Portland cement concrete surfaces abutting or projecting into asphalt pavement.
 2. Coat surfaces of curbs and gutters, and manhole, catch basin, and other structure frames with oil to prevent bond with asphalt pavement.
 - a. Do not tack coat these surfaces.

3.05 MIXING OF ASPHALT (BITUMINOUS) MATERIAL

- A. Mix uniformly, using dry material to avoid foaming.

3.06 CONSTRUCTION OF ASPHALT PAVING

- A. Provide engineered paving mat and asphalt (bituminous) surfacing material over base course as specified and in accordance with manufacturer's installation procedures.
- B. Clean, dry, and uniformly coat with asphalt emulsion film, surfaces of walls, concrete, masonry, or existing asphalt (bituminous) surfacing indicated to be in direct contact with installed asphalt (bituminous) surfacing.
- C. Thicken edges of asphalt (bituminous) surfacing that do not abut walls, concrete, or masonry, and edges joining existing asphalt (bituminous) surfaces.

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1. Remove headers at existing asphalt (bituminous) surfacing where new bituminous surfacing is to be installed.
 2. Thicken edges an additional 2 inches and taper to the indicated or specified thickness 6 inches back from such edges.
- D. Provide adequate protection for concrete, planting areas, and other finish Work adjacent to areas indicated to receive asphalt (bituminous) surfacing.
- E. Stakes or Screeds: Provide grade or screed stakes spaced not more than 15 feet apart in flow lines with grades of less than one percent.
1. Continuous screeds may be provided instead of stakes
- F. Placing – General:
1. Do not install asphalt (bituminous) surfacing when atmospheric temperature is below 40 degrees F or when fog or other unsuitable weather conditions are present.
 - a. Temperature of Mixture at Time of Installation:
 - 1) Not lower than 260 degrees F in warm weather or higher than 320 degrees F in cold weather.
 2. Where 2 inch or 3 inch thick asphalt (bituminous) surfacing is indicated or specified, install surfacing in one course.
 3. Where asphalt (bituminous) surfacing is indicated or specified 4 inches or more in thickness, except for thickened edges, install asphalt (bituminous) surfacing in courses of approximately equal thickness, with each course not exceeding 2-1/2 inches in thickness unless otherwise required by Architect.
- G. Placing Single Course Asphalt Pavement:
1. Install Work in accordance with Caltrans or SSPWC specifications.
 2. Place asphalt within 24 hours of applying primer or tack coat.
 3. Compact pavement by rolling to specified density.
 - a. Do not displace or extrude pavement from position.
 - b. Hand compact in areas inaccessible to rolling equipment.
 4. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.
- H. Spreading:
1. Install asphalt (bituminous) surfacing in manner to cause least possible handling of mixture
 2. In open areas and wherever practicable:
 - a. Install by mechanical means with self-propelled mechanical spreader.
 3. In confined or restricted areas:
 - a. Install mixture with hot shovels and rakes, and smooth with lutes.
- I. Joints:
1. Provide vertical joints between successive runs.
 - a. Install joints true to line, grade, and cross section.
 - b. Lapped joints are not permitted.
- J. Rolling:
1. Finish roll with self-propelled tandem roller weighing at least 8 tons.
 - a. Break down roll with self-propelled roller weighing between 1-1/2 tons and 8 tons.

2. Roll in manner that preserves flow lines and established finished grades.
 - a. Break down roll in areas adjacent to flow lines parallel to flow lines.
 - b. Break down roll after bituminous surfacing is installed without shoving or cracking of mixture under roller.
 - c. Continue finish rolling until surfacing is unyielding, true to grade, and meets requirements for specified smoothness.
 - d. Areas inaccessible to finish roller may be finish rolled with breakdown roller or tamped with hot tamping irons and smoothed with hot smoothing irons or hand roller.
 3. Where asphalt (bituminous) surfacing abuts concrete, masonry, and walks or paving, tamp joint smooth, when necessary, as described above to obtain uniformly even joint, true to line and grade.
 - a. Tamp and smooth to properly compact.
 4. Provide compacted asphalt (bituminous) surfacing with bulk specific gravity of at least 2.31 when tested in accordance with ASTM D 1188.
- K. Pavement at Heavy Duty Asphalt Paving Areas:
1. Single course of 3 inch compacted thickness, sand seal coat.

3.07 TOLERANCES

- A. Smoothness:
1. Ensure that surface of asphalt (bituminous) surfacing after rolling:
 - a. Is even, smooth, and uniform in texture with no voids or rock pockets
 - b. Free of roller marks, or other irregularities
 - c. Not varying by more than 1/8 inch, except at local depressions or raised areas as indicated, when 10 foot straightedge is placed on surface.
- B. Grade:
1. Finished Grade:
 - a. Not vary more than 0.02 foot above or below required grade.
 2. Compensate for variations within prescribed tolerance so that average grade and cross-section are provided.

3.08 FLOOD TESTING

- A. Flood test completed asphalt (bituminous) surfacing in presence of Project Inspector before seal coat has been installed.
1. Repair areas of standing water or puddles and flood test locally.

3.09 SEAL COAT

- A. General:
1. Allow asphalt (bituminous) surfacing to cure for minimum of 30 days, then apply two coats of surface seal as specified
 2. Where indicated, provide multiple coats of surface seal to existing asphalt (bituminous) surfacing.
- B. Surface Preparation:
1. After asphalt (bituminous) surfacing has passed flood test, thoroughly wash surfaces with water to remove dirt, debris, excessive oil and grease, or other foreign matter and allow to dry before applying seal coat.
 2. Apply seal coat after asphalt (bituminous) surfacing has passed flood test.

- C. Application:
 - 1. Install seal coat in strict accordance with manufacturer's written directions and recommendations.
 - 2. Install 2 coats of seal coat to new asphalt (bituminous) surfacing.
 - 3. Where new asphalt (bituminous) surfacing is installed adjacent to existing asphalt (bituminous) surfacing, overlap surface seal minimum of 12 inches onto existing asphalt (bituminous) surfacing.
 - 4. Where existing asphalt (bituminous) surfacing is indicated to be patched and sealed.
Apply 2 coats of surface seal after patching.

3.10 FIELD QUALITY CONTROL

- A. Additional Testing:
 - 1. Owner reserves right to obtain samples and perform tests to ensure compliance with Specifications, and to review weight slips and invoices of materials delivered to Project Site.
- B. Provide field inspection and testing.
 - 1. Take samples and perform tests in accordance with AI MS-2.

3.11 CLEANING

- A. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.

3.12 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for 7 days or until surface temperature is less than 140 degrees F.
 - 1. Protect Work until Substantial Completion.

END OF SECTION 32 1216

SECTION 32 1313

CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Exterior concrete paving for:
 - a. Walkways (sidewalks)
 - b. Curbs and gutters
 - c. Driveways.
 - 2. Work Includes:
 - a. Formwork
 - b. Reinforcing
 - c. Portland cement
- B. Related Sections
 - 1. Section 01 4500: Quality Control; testing and inspection of concrete.
 - 2. Section 01 5000: Temporary Facilities and Controls; barriers and temporary controls.
 - 3. Section 07 9200: Joint Sealants; traffic sealants.
 - 4. Section 31 0000: Earthwork; excavation, backfilling, and grading requirements.
 - 5. Section 32 0523: Concrete for Exterior Improvements; concrete for items other than paving.
 - 6. Section 32 1100: Base Course
 - 7. Section 32 1216: Asphalt Paving
 - 8. Section 32 1723: Pavement Markings

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. ASTM A767 – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
 - 3. ASTM A 1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 4. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
 - 5. ASTM C 33 – Standard Specification for Concrete Aggregates
 - 6. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 7. ASTM C 94 – Standard Specification for Ready-Mixed Concrete
 - 8. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
 - 9. ASTM C150 – Standard Specification for Portland Cement
 - 10. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete
 - 11. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete
 - 12. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

13. ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete
 14. ASTM C 494 – Standard Specification for Chemical Admixtures for Concrete
 15. ASTM C979 – Standard Specification for Pigments for Integrally Colored Concrete
 16. ASTM C 1059 – Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete
 17. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
 18. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
 19. ASTM D 1752 – Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
- B. American Concrete Institute (ACI):
1. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
 2. ACI 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
 3. ACI 305R – Specification for Hot Weather Concreting
 4. ACI 306R – Guide to Cold Weather Concreting
 5. ACI 308R – Guide to External Curing of Concrete.
 6. ACI 309R – Guide for Consolidation of Concrete.
- C. Concrete Reinforcing Steel Institute (CRSI):
1. CRSI Manual of Standard Practice.
 2. CRSI Placing Reinforcing Bars
- D. West Coast Lumber Inspection Bureau (WCLIB):
1. Standard Grading Rules No. 17, 2004.
- E. South Coast Air Quality Management District (SCAQMD):
1. Rule 1113 – Architectural Coatings

1.03 SUBMITTALS

- A. Product Data:
1. For each type of manufactured material and product indicated.
- B. Design Mixes:
1. For each concrete pavement mix.
 2. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1.04 QUALITY ASSURANCE

- A. Concrete Standards:
1. Comply with provisions of referenced standards, except where more stringent requirements are indicated.
- B. Provide Portland cement concrete paving that is stable, firm, and slip resistant, complying with CBC Sections 11B-302 and 11B-403.

- C. Concrete Manufacturer Qualifications:
 - 1. Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- D. Installer Qualifications:
 - 1. 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.
- E. Concrete Testing Service:
 - 1. Engage qualified independent testing agency to design concrete mixes.
- F. Field-Constructed Mockup:
 - 1. Cast 6 foot square mockup of each concrete type scheduled to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
 - a. Construct mock-up slab panels for following finishes as applicable:
 - 1) Medium Textured Broom Finish
 - 2) Heavy (Coarse) Textured Broom Finish
 - 2. Provide Control Joint (CJ) and Expansion Joint (EJ) in each mockup.
 - 3. Construct mockups in location and of size indicated or, when not indicated, as directed by Architect.
 - 4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 5. Obtain Architect's acceptance of mockups before starting construction.
 - 6. Should Architect determine that mockup does not meet requirements, demolish and remove it from Project Site, and cast another until mockup is accepted.
 - 7. Maintain accepted mockup undisturbed during construction as standard for judging completed pavement.
 - 8. Demolish accepted mockup and remove from Project Site when directed by Architect.
 - a. Accepted mockups may become part of completed Work where undisturbed at time of Substantial Completion.
- G. Preinstallation Conference:
 - 1. Conduct conference at Project Site complying with requirements in Section 01 3119
 - 2. Before submitting design mixes, review concrete pavement mix design and examine procedures for ensuring quality of concrete materials.
 - a. Require representatives of each entity directly concerned with concrete pavement to attend, including following:
 - 1) Contractor's superintendent.
 - 2) Independent testing agency responsible for concrete design mixes.
 - 3) Ready-mix concrete producer.
 - 4) Concrete subcontractor.

1.05 PROJECT CONDITIONS

- A. Traffic Control:
 - 1. Maintain access for vehicular and pedestrian traffic as required for other construction activities.
 - 2. Comply with other requirements specified in Section 01 5000.

PART 2 PRODUCTS

2.01 GENERAL

- A. Batch concrete in certified plant capable of achieving Waiver of Continuous Batch Plant and Materials Tests.
- B. Produce each type and color of concrete in same batch plant.
- C. Refer to Section 32 1100 for base course materials.

2.02 FORMWORK

- A. Forms:
 - 1. Metal, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal and to provide full depth, continuous straight, smooth exposed surfaces.
 - 2. Use flexible or curved forms to form radius bends as required.
 - a. Do not use notched and bent forms.
- B. Form Release Agent:
 - 1. Provide commercial formulation form-release agent complying with local Volatile Organic Compound (VOC) limitations that will not bond with stain. or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.03 REINFORCING MATERIALS

- A. Reinforcing Bars:
 - 1. Conforming to ASTM A 615, Grade 40, deformed.
- B. Joint Dowel Bars:
 - 1. Plain Steel Bars:
 - a. Conforming to ASTM A 615, Grade 60.
 - 2. Zinc coated (galvanized) after fabrication according to ASTM A 767, Class I coating
 - 3. Cut bars to length with ends square and free of burrs.
 - 4. Provide polyethylene closed-end sleeve or approved alternate at expansion joint dowels
- C. Bar Supports:
 - 1. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and dowels in place.
 - 2. Manufacture bar supports, according to CRSI Manual, from steel wire, plastic, or precast concrete or fiber reinforced concrete of greater compressive strength than concrete, and as follows:
 - a. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.04 CONCRETE MATERIALS

- A. Use same brand and type of cementitious material from same manufacturer throughout Project.
- B. Portland Cement:
 - 1. Conforming to ASTM C 150, Type II
 - 2. Color: **CP-1** – Natural Gray, for non-colored locations
- C. Aggregate:
 - 1. Normal-Weight:
 - a. Conforming to ASTM C 33, uniformly graded, from single source, with coarse aggregate as follows:
 - 1) Class: 1N.
 - 2. Maximum Aggregate Size: 1 inch nominal.
 - 3. Do not use fine or coarse aggregates containing substances that cause spalling.
- D. Water:
 - 1. Conforming to ASTM C 94.

2.05 ADMIXTURES

- A. Certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture:
 - 1. Conforming to ASTM C 260.
- C. Water-Reducing Admixture:
 - 1. Conforming to ASTM C 494, Type A.
- D. Color Pigment:
 - 1. Conforming to ASTM C 979
 - a. Synthetic mineral-oxide pigments or colored water reducing admixtures
 - 2. Color stable, nonfading, and resistant to lime and other alkalis.
 - 3. Minimum of one-fifth unit per sack of cement.
 - 4. Colors:
 - a. As selected by Architect
 - b. Manufacturer's full line, by Davis Colors or L.M Scofield, as indicated.

2.06 CURING MATERIALS

- A. Moisture-Retaining Cover:
 - 1. Conforming to ASTM C 171
 - a. Non-staining, reinforced, waterproof sheet.
- B. Water: Potable.
- C. Integrally Colored Concrete:
 - 1. Curing compound recommended by manufacturer of color admixture.

2.07 RELATED MATERIALS

- A. Control Joint Material:
 - 1. Expansion Joint Filler Material:
 - a. Fiber Type Expansion Joint Filler:
 - 1) Resilient, flexible, non-extruding, composed of cellular fibers securely bonded together and uniformly saturated with asphalt to
 - 2) Conforming to ASTM D 1751.
 - 3) Fibre Expansion Joint by W.R. Meadows, or approved equal.
 - b. Cork Type Expansion Joint Filler:
 - 1)
 - 2. Plain or punched for dowels as required.
- B. Bonding Agent:
 - 1. Conforming to ASTM C 1059, Type II
 - a. Acrylic emulsion or styrene butadiene.

2.08 CONCRETE MIX DESIGN

- A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301.
 - 1. For trial batch method, use qualified independent testing agency for preparing and reporting proposed mix designs.
 - a. Do not use Owner's field quality-control testing agency as independent testing agency.
 - 2. Limit use of fly ash to 15 percent of cement content by weight.
- B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with following properties:
 - 1. Compressive Strength:
 - a. 3,000 psi at 28 days when tested in accordance with ASTM C39:
 - b. Slump Range: 3 inches to 4 inches.
 - c. Water-Cement Ratio: Maximum 50 percent by weight.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content of 2.5 percent to 4.5 percent.

2.09 CONCRETE MIXING

- A. Ready-Mixed Concrete:
 - 1. Comply with specified requirements and ASTM C 94 and following:
 - a. When air temperature is between 85 degrees F and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes
 - b. When air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction.

1. Do not begin paving work until such conditions have been corrected and subbase is ready to receive paving.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations.
 1. Install forms to allow continuous progress of Work and so forms can remain in place at least 24 hours after concrete placement.
- B. Check completed formwork and screeds for grade and alignment to following tolerances:
 1. Top of Forms:
 - a. Not more than 1/8 inch in 10 feet.
 2. Vertical Face on Longitudinal Axis:
 - a. Not more than 1/4 inch in 10 feet.
- C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.03 PLACING REINFORCEMENT

- A. Follow CRSI recommended practice for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. When specified or indicated, install welded wire fabric in lengths as long as practicable:
 1. Lap adjoining pieces at least one full mesh and lace splices with wire.
 2. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.04 JOINTS

- A. Construct control, construction, and expansion joints and tool edgings true to line with faces perpendicular to surface plane of concrete.
 1. Construct transverse joints at right angles to centerline, unless indicated otherwise.
 2. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.
- B. Tooled Control Joints (CJ):
 1. Form tooled control joints after initial floating by grooving and finishing each edge of joint with groover tool to radius as indicated or specified.
 - a. Repeat grooving of control joints after applying surface finishes.
 - b. Eliminate tool marks on concrete surfaces.

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2. Jointer Tool:
 - a. 1/4 inch wide at surface, tapered, with top edges rounded to 1/4 inch radius.
3. Location:
 - a. As shown on Drawings, but not more than 15 feet on center both ways.
 - b. Typical Sidewalk Joints:
 - 1) Make joints 5 feet on center, or as directed by Architect.
- C. Sawed Joints:
 1. Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades.
 2. 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.
 3. Prior approval of Architect is required for sawed joints.
- D. Edging:
 1. Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with edging tool to specified radius.
 2. Repeat tooling of edges after applying surface finishes.
 - a. Eliminate tool marks on concrete surfaces.
 3. Radius:
 - a. 1/4 inch, unless indicated otherwise.
- E. Construction Joints (CJ):
 1. Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.
 2. Continue reinforcement across construction joints unless indicated otherwise.
 3. Do not continue reinforcement through sides of strip paving unless indicated.
 4. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- F. Expansion Joints (EJ):
 1. Provide in exterior concrete paving on grade at maximum interval of 30 feet on center or as noted.
 2. Form expansion joints of preformed joint filler strips as follows:
 - a. At intersections with vertical surfaces.
 - b. At surfaces abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated
 - c. At other penetrations through paving.
 3. Joint Fillers:
 - a. Use fiber type expansion joint fillers typically and depress 1/4 inch unless otherwise noted.
 - b. Use cork type expansion joint fillers at conditions with non-bituminous waterproofing, liquid waterproofing, or sealant systems.
 - c. Where more than one length is required, lace or clip joint filler sections together.
 - d. Do not leave gaps between ends of joint filler units.
 - e. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap.
 - 1) Remove protective cap after concrete has been placed on both sides of joint.

4. Install dowel bars and support assemblies at joints where indicated.
 - a. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.
- G. Installation of Sealants:
 1. Comply with requirements of Section 07 9200 and following:
 - a. Install sealant to depths recommended by sealant manufacturer but within following general limitations, measured at center section of bead:
 - 1) For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but not more than 1/2 inch deep or less than 3/8 inch deep.
 - b. Tool joints to form smooth, uniform beads with slightly concave surfaces, with finished joints straight, uniform, smooth and neatly finished.
 - c. Remove excess sealant from adjacent surfaces of joint, leaving Work in neat, clean condition.
 - d. Do not use tooling agents unless recommended by sealant manufacturer.

3.05 CONCRETE PLACEMENT

- A. Inspection:
 1. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in.
 2. Notify other trades to permit installation of their work.
- B. Moisten subbase to provide uniform dampened condition at time concrete is placed.
 1. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Comply with requirements and ACI 304R for measuring, mixing, transporting, and placing concrete.
- D. Deposit and spread concrete in continuous operation between transverse joints.
 1. Do not push or drag concrete into place or use vibrators to move concrete into place.
 2. When concrete placing is interrupted for more than 1/2 hour, place construction joint.
- E. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping.
 1. Use equipment and procedures to consolidate concrete complying with ACI 309R.
 2. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator.
 3. Keep vibrator away from joint assemblies, reinforcement, or side forms.
 4. Use only square-faced shovels for hand-spreading and consolidation.
 5. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.
- F. Screed paved surfaces with straightedge and strike off.
 1. Use bull floats or darbies to form smooth surface plane before excess moisture or bleed water appears on surface.
 2. Do not further disturb concrete surfaces prior to beginning finishing operations.

- G. Hot-Weather Placement:
1. Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
 - a. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F.
 - 1) Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
 - 2) Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete.
 4. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

- A. Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish:
1. Begin floating when bleed water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations.
 2. Float surface with power-driven floats, or by hand floating, where area is small or inaccessible to power units.
 3. Finish surfaces to true planes within tolerance of 1/4 inch in 10 feet as determined by 10 foot long straightedge placed anywhere on surface in any direction.
 4. Cut down high spots and fill low spots.
 5. Refloat surface immediately to uniform granular texture.
- C. Broom Finish:
1. Medium Textured Broom Finish:
 - a. For slopes less than 6 percent, provide medium texture by drawing soft bristle broom across concrete surface perpendicular to line of traffic to provide uniform fine line texture finish.
 2. Heavy (Coarse) Textured Broom Finish:
 - a. For slopes 6 percent and greater, provide coarse finish by striating surface 1/16 inch to 1/8 inch deep with stiff-bristled broom, perpendicular to line of traffic.

3.07 CURING AND PROTECTION

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

- B. Evaporation Retarder:
 - 1. Apply evaporation retarder to concrete surfaces when hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations.
 - 2. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Curing Methods:
 - 1. Cure concrete by moisture curing, moisture-retaining-cover curing, curing compounds, or combination of following:
 - a. Moisture Curing:
 - 1) Keep surfaces continuously moist for not less than seven days with following materials:
 - a) Water.
 - b) Continuous water-fog spray.
 - c) Absorptive cover, water saturated, and kept continuously wet.
 - 2) Cover concrete surfaces and edges with 12 inch lap over adjacent absorptive covers.
 - b. Moisture-Retaining-Cover Curing:
 - 1) 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.
 - 2) Immediately repair any holes or tears during curing period using cover material and waterproof tape. .

3.08 FIELD QUALITY CONTROL

- A. Testing Services:
 - 1. Perform testing according to following requirements:
 - a. Sampling Fresh Concrete:
 - 1) Obtain representative samples of fresh concrete according to ASTM C 172, except as modified for slump to comply with ASTM C 94.
 - b. Slump Tests:
 - 1) Conforming to ASTM C 143:
 - a) One test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete.
 - 2) Additional tests will be required when concrete consistency changes.
 - c. Compression Test Specimens:
 - 1) Conforming to ASTM C 31:
 - a) One set of four standard cylinders for each compressive-strength test, unless directed otherwise.
 - 2) Mold and store cylinders for laboratory cured test specimens except when field-cured test specimens are required.
 - d. Air Content:
 - 1) Conforming to ASTM C 231 – Pressure Method:

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- a) One test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
 - e. Concrete Temperature:
 - 1) Conforming to ASTM C 1064:
 - a) One test hourly when air temperature is 40 degrees F, and below and when 80 degrees F and above.
 - b) One test for each set of compressive strength specimens.
 - f. Compressive-Strength Tests:
 - 1) Conforming to ASTM C 39:
 - a) One set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd.
 - 2) Test one specimen at 7 days and two specimens at 28 days
 - 3) Retain one specimen in reserve for later testing when required.
 - g. When frequency of testing will provide fewer than five compressive-strength tests for given class of concrete, conduct testing from at least five randomly selected batches or from each batch when fewer than five are used.
 - h. When total quantity of given class of concrete is less than 50 cu. yd., Architect may waive compressive-strength testing when adequate evidence of satisfactory strength is provided.
 - i. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide for corrective procedures for:
 - 1) Protecting and curing in-place concrete.
 - j. Strength level of concrete will be considered satisfactory when averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.
- 2. Report test results in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing.
 - a. Submit Reports of compressive-strength tests containing following:
 - 1) Project identification name and number
 - 2) Date of concrete placement
 - 3) Name of concrete testing agency
 - 4) Concrete type and class
 - 5) Location of concrete batch in pavement
 - 6) Design compressive strength at 28 days
 - 7) Concrete mix proportions and materials
 - 8) Compressive breaking strength
 - 9) Type of break for both 7 and 28 day tests.
 - 3. Nondestructive Testing:
 - a. Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection.
 - 4. Additional Tests by Testing Agency:
 - a. Make additional tests of concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect.

- b. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.09 REPAIRS

- A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet requirements of this Section.
- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas.
 - 1. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to paving with epoxy adhesive.

3.10 CLEANING

- A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

3.11 PROTECTION

- A. Protect concrete from damage.
 - 1. Exclude traffic from paving for at least 14 days after placement.
 - 2. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
 - 1) Protect the Work of this section until date of Substantial Completion.

END OF SECTION 32 1313

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SECTION 32 1723

PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Parking lot striping:
 - a. Includes markings and accessibility symbols, for accessible paths of travel where indicated.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 32 1216: Asphalt Paving; accessible path of travel.

1.02 REFERENCES

- A. California Code of Regulations, Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
 - 1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.
- B. Federal Specifications (FS):
 - 1. FS TT-P-1952 – Paint, Traffic and Airfield Marking, Waterborne, current version.
- C. Federal Standards (FED-STD):
 - 1. FED-STD 595C – Colors Used in Government Procurement, current version.
- D. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1113 – Architectural Coatings

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product data on traffic paint products and material.
- B. Shop Drawings:
 - 1. Indicating location, extent, color, and texture of markings.
- C. Samples:
 - 1. Color samples of paint products.

1.04 PROJECT CONDITIONS

- A. In-Service Surface Temperature Limits:
 - 1. Dry: 50 degrees F minimum.
 - 2. Do not apply when air, surface, or product temperatures are below 50 degrees F, or when adverse weather conditions are forecast.
- B. Dry Time at 77 degrees F and 50 percent Relative Humidity:

1. Drying times will vary depending on temperature, air circulation, and humidity.

1.05 REGULATORY REQUIREMENTS

- A. Accessible Parking:
 1. Provide accessible parking spaces and access aisles comply with CBC Section 11B-502.
 2. Locations and dimensions are indicated on Drawings.
 - a. Includes markings and accessibility symbols

PART 2 PRODUCTS

2.01 MATERIALS

- A. Traffic Marking Paint:
 1. 100 percent Acrylic Resin System:
 - a. Ready-mixed, one-component, waterborne acrylic traffic line paint.
 - b. High Solids formulated for hot and cold application to either asphalt concrete or Portland cement concrete pavements.
 2. Meets performance standards of FS TT-P-1952, Type II.
 3. VOC Content: Less than 100g/L
 4. Colors:
 - a. Specified colors conforming to FED-STD 595C.
 5. Product and Manufacturer:
 - a. Fast Dry Paint Series by American Traffic Products, Rialto, CA, or approved equal.

PART 3 EXECUTION

3.01 PAVEMENT MARKINGS

- A. Application of Paint:
 1. Prior to application of paint, allow pavement to properly cure.
 - a. Clean and prepare in accordance with paint manufacturer's written recommendations.
 2. Provide mechanical equipment to install paint in a uniform, straight or curved pattern, without holidays and other defects.
 3. Do not permit traffic until paint has completely cured.
 4. Install 2 coats in thickness recommended by manufacturer.
- B. Marking Width and Color:
 1. Unless indicated otherwise, marking width and color are as follows:

	<u>Width</u>	<u>Color</u>
a. Striping	4 inches	
1) General		Yellow
2) Accessible		Blue
b. International Symbol of Accessibility (ISA)	2 inches	White on blue background

3.02 CLEANING

- A. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.

3.03 PROTECTION

- A. Protect Work:
 - 1. With barricades and signs until paint has completely dried and until Substantial Completion and acceptance by Owner.

END OF SECTION 32 1723

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SECTION 32 1726

TACTILE WARNING SURFACING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cast In Place Detectable/Tactile Warning Surface Tiles (truncated domes) where indicated.
- B. Related Sections:
 - 1. Section 01 4100: Regulatory Requirements; current Code edition.
 - 2. Section 32 0523: Concrete for Exterior Improvements
 - 3. Section 32 1313: Concrete Paving
 - 4. Section 32 1723: Pavement Markings.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
 - 1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.
- B. ASTM International (ASTM):
 - 1. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 2. ASTM C 293 – Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading)
 - 3. ASTM C1026 – Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling
 - 4. ASTM D 543 – Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
 - 5. ASTM D 570 – Standard Test Method for Water Absorption of Plastics
 - 6. ASTM D 638 – Standard Test Method for Tensile Properties of Plastics
 - 7. ASTM D 695 – Standard Test Method for Compressive Properties of Rigid Plastics
 - 8. ASTM D 790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 - 9. ASTM D 1037 – Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
 - 10. ASTM D 1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
 - 11. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
 - 12. ASTM G 155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
- C. Federal Standard (FS):
 - 1. Federal Standard 595C – Colors Used in Government Procurement, current version.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's literature describing products, installation procedures and routine maintenance.
- B. Shop Drawings:
 - 1. Show fabrication details for specified products, consisting of:
 - a. Composite structural system
 - b. Tile surface profile
 - c. Sound on cane contact amplification feature.
 - 2. Include plans of tile placement including joints, and material to be used.
 - a. Outline installation materials and procedure
 - 3. Design and show tile pattern between existing expansion joints with tile rib dimension used for cut size of panels.
- C. Samples:
 - 1. Minimum of four samples, as Project Site mock-ups, of full cast in place detectable/tactile warning surface tiles of kind proposed for use.
- D. Material Test Reports:
 - 1. From qualified accredited independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet properties indicated.
 - 2. Conduct test reports on cast in place detectable/tactile warning surface tiles as certified by qualified independent testing laboratory.
 - 3. Do not include manufacturer's MSDS sheets with this submittal.
 - a. Furnish to Contractor only.
- E. Maintenance Instructions:
 - 1. Copies of manufacturer's specified maintenance practices for cast-in-place detectable/tactile warning surface tiles

1.04 QUALITY ASSURANCE

- A. Provide cast in place detectable/tactile warning surface tiles and accessories as produced by single manufacturer with minimum of three years experience in manufacturing of cast in place detectable/tactile warning surface tiles.
- B. Installer's Qualifications:
 - 1. Engage experienced installer certified in writing by detectable/tactile warning surface tile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
 - 2. Arrange for manufacturer's supervisor to be present at initial pour for cast-in-place tiles.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Suitably package or crate tiles to prevent damage in shipment or handling.
 - 1. Protect finished surfaces with sturdy wrappings, and identify tile type by part number.

- B. Deliver tiles to designated location at Project Site for storage prior to installation.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions and Protection:
1. Maintain minimum temperature of 40 degrees F in spaces to receive tiles for at least 24 hours prior to installations, during installation, and for not less than 24 hours after installation.
 2. Store tile material in spaces where they will be installed for at least 24 hours before beginning installation.
 3. After installation, maintain minimum temperature of 40 degrees F in areas where Work is completed.
- B. Contain and control use of water for Work, cleaning, or dust control.
1. Do not allow waste water to come into contact with public.
 2. Provide barricades or screens to protect public.
- C. Conduct disposal of liquids or other materials of possible contamination in accordance with federal state and local laws and ordinances.
- D. Use cleaning materials with code-compliant low VOC solvent content and low flammability when used on Project Site.
- E. Coordinate phasing and flagging personnel operations as specified in Division 01.

1.07 REGULATORY REQUIREMENTS

- A. Tactile Warning Surfacing:
1. Provide tactile warning surfaces complying with CBC Section 11B-705.1
 2. Surfacing Color: No. 33538 "Federal Yellow" conforming to FS 595C.
 - a. Exception:
 - 1) Provide colors used for locations at curb ramps, islands, or cut-through medians that contrast visually with color of adjacent walking surfaces.
 - b. Provide either light-on-dark, or dark-on-light, in accordance with CBC Section 11B-705.1.1.3.
 3. Provide surfacing that differs from adjoining surfaces in resiliency or sound-on-cane contact in accordance with CBC Section 11B-705.1.1.4.

1.08 WARRANTY

- A. Provide manufacturer's minimum 5 year warranty in writing for period of five years from date of final completion complying with DSA Bulletin 10/31/02, revised 04/09/08.
1. Warranty includes defective work, breakage, deformation, fading and chalking of finishes, and loosening of tiles.

PART 2 PRODUCTS

2.01 MANUFACTURERS/PRODUCTS

- A. Provide detectable warning surface tile by one of following:
1. Engineered Plastics, Inc. (Armor-Tile)
 2. ADA Solutions, Inc.

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3. Armorcast Products
- B. Basis-of-Design Product:
 1. Vitrified Polymer Composite (VPC) Cast in Place Detectable/Tactile Warning Surface Tiles specified is based on Armor-Tile as manufactured by Engineered Plastics Inc.
 2. Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in Work and provided they meet or exceed specified test criteria and characteristics.

2.02 MATERIALS

- A. Tiles:
 1. Made of homogeneous vitrified polymer composite (VPC) material with ultraviolet stabilized coating, to minimize color wear
 2. Provide with slip-resistant surface, incorporating “truncated domes” of same material.
 3. Nominal thickness of detectable warning tile: 1/8 inch, exclusive of height of truncated domes.
 4. Provide tiles complying with applicable requirements of CBC, Chapter 11B.
- B. Vitrified Polymer Composite (VPC) cast-in-place detectable/tactile warning surface tiles:
 1. Epoxy polymer composition with ultra violet coating employing aluminum oxide particles in truncated domes, conforming to following:
 - a. Compressive Strength per ASTM D 695:
 - 1) Not less than 18,000 psi.
 - b. Tensile Strength per ASTM D 638:
 - 1) Not less than 10,000 psi.
 - c. Flexural Strength per ASTM C 293 or D 790:
 - 1) Not less than 24,000 psi.
 - d. Water Absorption per ASTM D 570:
 - 1) Not to exceed 0.35 percent.
 - e. Slip Resistance:
 - 1) Minimum 0.9 for combined wet/dry static co-efficient of friction when tested per ASTM C 1028
 - f. Chemical Stain Resistance per ASTM D 543 or D 1038:
 - 1) Withstand without discoloration or staining minus 1 percent hydrochloric acid, urine, calcium chloride, stamp pad ink, gum and red aerosol paint.
 - g. Fire-Resistance per ASTM E 84:
 - 1) Flame Spread Index: Less than 15.
 - h. Accelerated Weathering per ASTM G 155:
 - 1) Exhibit following result for 3000 hours:
 - a) Delta E, less than 4.5: No deterioration, fading or chalking of surface of tile.
 - i. Accelerated Aging and Freeze Thaw Test per ASTM D 1037 or C1026:
 - 1) Show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening of tiles, or other defects.
 - j. Salt and Spray Performance of Tile per ASTM B 117:
 - 1) Not show deterioration or other defects after 200 hours of exposure.

- C. Pattern/Dimension:
 - 1. Provide detectable warning surface tile incorporating "in-line" pattern of truncated domes 0.2 inch in height, 0.9 inch minimum and 0.092 inch maximum diameter at base, and 0.45 inch minimum and 0.47 inch maximum diameter at top of dome.
 - 2. Space domes at 2.3 inches minimum to 2.4 inches maximum center-to-center, measured "in-line"
 - 3. Wheelchair Safety:
 - a. Provide field area of detectable warning surface consisting of non-slip surface with minimum of 40 degree to 90 degree raised points, 0.045 inch high, per square inch
- D. Color:
 - 1. Unless otherwise indicated, provide detectable warning surface tiles in color specified in Article 1.07 A
 - 2. Provide color integral with detectable warning device tiles and not surface applied.
 - 3. Do not use paints or other surface coatings.
- E. Sealants:
 - 1. Gray epoxy, two-component sealant.
 - a. Manufactured by Sika, Bostik or approved equal.
 - b. Complying with requirements of Section 07 9200.
 - 2. As supplied by tile manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION OF CAST-IN-PLACE TILES

- A. During concrete pouring and tile installation procedures, ensure adequate safety guidelines are in place and are in accordance with applicable industry and government standards.
- B. Prior to placement of cast in place detectable/tactile warning surface tiles, review manufacturer's shop drawings and layout drawing prepared by installation contractor to resolve issues related to pattern repeat, tile cuts, expansion joints, control joints, curves, end returns and surface interferences.
 - 1. Refer discrepancies to Architect.
- C. Physical Characteristics of Concrete:
 - 1. Consistent with Section 32-1313 specifications while maintaining slump range of 4 to 7 inches to permit solid placement of cast in place detectable/tactile warning surface tiles.
 - 2. Overly wet mix will cause tiles to float.
 - a. Furnish suitable weights such as concrete blocks or sandbags (25 lbs.)
 - 1) Place on each tile.
- D. Concrete pouring and finishing operations require typical mason's tools.
 - 1. Four foot long level with electronic slope readout, 25 lb. weights, and large non-marring rubber mallet are specific to installation of cast-in-place detectable/tactile warning surface tiles.
 - 2. Vibrating mechanism may be employed.
 - a. Fix vibrating unit to soft wood base at least 1 foot square.

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- E. Pour and finish concrete true and smooth to required dimensions and slope prior to tile placement.
 - 1. Immediately after pouring concrete, use electronic level to check that required slope is achieved
 - 2. Place tile square and true to curb edge in accordance with approved shop drawings.
 - 3. Tamp or vibrate Tiles into fresh concrete to ensure that field level of tile is flush to adjacent concrete surface.
 - a. Do not attempt to accomplish embedment process by stepping on tiles as this may cause uneven setting which can result in air voids under tile surface
 - 4. Shop drawings indicate that tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.
 - a. Tolerance for elevation differences between tile and adjacent surface is 1/16 inch.
- F. Immediately after tile placement, tile elevation is to be checked to adjacent concrete.
 - 1. Set tile elevation consistent with shop drawings to permit water drainage to curb as design dictates.
 - 2. Ensure field surface of tile is flush with surrounding concrete and back of curb so that no ponding of possible on tile at back side of curb
- G. While concrete is workable, use 3/8 inch edging tool to create finished edge of concrete.
 - 1. Use steel trowel to finish concrete around tile perimeter, flush to field level of Tile.
- H. During and after tile installation and concrete curing stage, do not allow walking, leaning, or external forces placed on tile to rock tile, causing void between underside of tile and concrete.
- I. Following tile placement, review installation tolerances to shop drawings and adjust tile before concrete sets.
 - 1. Place suitable weights of 25 lbs. on each tile and additional weights at tile to tile assemblies as necessary to ensure solid contact of tile underside to concrete.
- J. Following curing of concrete, remove protective plastic wrap from tile face by cutting plastic with sharp knife tight to concrete/tile interface.
 - 1. Where concrete bleeding occurs between tiles, soft brass wire brush will clean residue without damage to tile surface.
- K. Individual tiles may be bolted together with 1/4 inch bolts or equivalent hardware to help ensure adjacent tiles are flush to each other during installation process.
 - 1. Place tape or sealant on underside of bolted edge to prevent concrete from rising up between tiles during installation
 - a. Replace protective plastic wrap peeled back to facilitate bolting or cutting by taping to ensure tile surface remains free of concrete during installation process
 - 2. Replace sound-amplifying plates on underside of tile dislodged during handling or cutting and secure with construction adhesive
 - a. Air gap created between plates and bottom of tile is important in preserving sound on cane audible properties of tiles.

3. Applications of Sealant:
 - a. Install level to adjacent surface and straight line formed to tile edge.
 - b. Mask off tile faces with duct tape to ensure clean definition of sealant to adjacent surfaces.

3.02 PAVEMENT MARKINGS

- A. Refer to Section 32 1723 for coordination of pavement markings with tactile warning surface locations.

3.03 CLEANING AND PROTECTING

- A. Protect panels against damage during construction period to comply with tile manufacturer's specification.
- B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardboard.
- C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of Substantial Completion in each area of Project.
 1. Clean tile by method specified by manufacturer.
- D. Comply with manufacturer's maintenance manual for cleaning and maintaining tile surface.
 1. Perform recommended annual inspections for safety and tile integrity
- E. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.
- F. Protect Work until Substantial Completion.

END OF SECTION 32 1726

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SECTION 32 3113

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Chain link fencing for exterior installation, where indicated on Drawings and as follows:
 - a. Chain Link Fencing 8 feet – 0 inches high:
 - 1) North and South perimeter
 - 2) Free-standing under Home Bleachers.
 - 3) Attached to structure, under Visitor Bleachers.
 - b. Chain link fence, 4 feet – 0 inches high.
 - 1) Pedestrian barrier fence and gates surrounding track area on 3 sides.
 - 2. Finish for Chain Link Fences and Gates:
 - a. Vinyl coated.
 - b. Painted where vinyl coating is not available.
 - 3. Chain Link Gates:
 - a. Pedestrian Swing Gates:
 - b. Rolling Vehicle Gates:
 - 1) Manually operated.
 - c. Vinyl coated gate fabric, posts, and gate framing.
 - d. Gate hardware and related accessories.
- B. Items Not Included:
 - 1. Padlocks:
 - a. Padlocks where required, will be provided by Owner.
- C. Related Sections:
 - 1. Section 01 2300: Alternates; alternate fence types.
 - 2. Section 01 4100: Regulatory Requirements; current Code edition.
 - 3. Section 03 3000: Cast-in-Place Concrete; fence post footings.
 - 4. Section 32 3119: Decorative Metal Fences and Gates; Alternate 1.

1.02 REFERENCES

- A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
 - 1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.
- B. ASTM International (ASTM):
 - 1. ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 2. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 3. ASTM A 392 – Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric

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4. ASTM A641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 5. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 6. ASTM F 567 – Standard Practice for Installation of Chain-Link Fence
 7. ASTM F 668 – Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric
 8. ASTM F 1043 – Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
 9. ASTM F 1083 – Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
- C. Chain Link Fence Manufacturer's Institute (CLFMI):
1. Product Manual
 2. WLG2445 – Chain Link Fence Wind Load Guide for the Selection of Line Posts and Line Post Spacing.
- D. Federal Specifications (FS):
3. RR-F-191/3E - Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)
- E. West Coast Lumber Inspection Bureau, (WCLIB):
4. Standard Grading Rules No. 17

1.03 DEFINITIONS

- A. Chain Link Fabric:
1. Fencing material consisting of wire helically wound and interwoven in such manner as to provide continuous mesh without knots or ties except in form of knuckling or twisting at top and bottom of mesh to form fabric selvage.
- B. Selvage:
1. Top and bottom edge finish on woven chain link formed by joining adjacent pairs of wire pickets.
- C. Knuckled Selvage:
1. Refers to bending of adjacent pairs of wire back into tight loop.
- D. Mesh Size:
1. Minimum clear distance between wires forming parallel sides of mesh.
- E. Terminal Post:
1. Post to which chain link fabric is terminated using specific fittings.
 2. Consisting of end post, corner post, gate post and pull post.
 3. Terminal post may be used to accommodate grade or placed at intervals on long stretches of fence.
- F. Line post:
1. Intermediate posts set no greater than 10 feet on center between terminal posts.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data, specifications, and installation instructions for chain link fence and gates.
- B. Shop Drawings:
 - 1. Site Plan showing layout of fence locations and indicate following:
 - a. Dimensions.
 - b. Location of gates and opening size.
 - c. Cleared area.
 - d. Elevation of fence, gates, and footings.
 - e. Details of attachments.
 - 2. Include accessories, fittings, hardware, anchorages, and schedule of components.
- C. Samples:
 - 1. Vinyl coated fabric, in each mesh size specified, for color.
 - a. Four samples, minimum 12 by 12 inches.
 - 2. Gate Hardware and Components:
 - a. Vinyl coated components for color.
 - 3. Painted Finish:
 - a. Four samples, minimum 4 by 6 inches on same metal as that to be painted..

1.05 QUALITY ASSURANCE

- A. Comply with standards of Chain Link Fence Manufacturer's Institute (CLFMI).
- B. Provide chain link fence and gates as produced by single manufacturer including necessary erection accessories, fittings, and fastenings.

PART 2 PRODUCTS

2.01 FABRIC

- A. Zinc-Coated Steel Fabric:
 - 1. Conforming to ASTM A 392, Class 1, galvanized before weaving (GBW)
 - a. Top and bottom selvages knuckled.
 - 2. Provide 11 gage wires in 2 inch mesh, unless noted otherwise.
- B. Vinyl Coated Fabric:
 - 1. Vinyl Coated Fabric:
 - a. Conforming to ASTM F 668, Class 2b, PVC.
 - b. Color: Black.
 - 2. Provide one piece fabric, full height.
 - a. Except where fence height exceeds maximum fabric height:
 - 1) Provide horizontal rail at joint in fabric, where indicated.

2.02 POSTS, RAILS, AND ASSOCIATED ITEMS

- A. Posts:
 - 1. Round steel pipe and rails complying with ASTM F 1043.

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- a. Material Design Group IA, Table 3 – Heavy Industrial Fence Framework.
 2. Schedule 40 galvanized pipe conforming to ASTM F 1083
 - a. ASTM F 1043, Material Design Group IA
 - 1) External and internal coating Type A.
 3. Intermediate Line Posts for fabric heights:
 - a. Up to and including 6 feet: 1.9 inch O.D., 2.72 lb/ft.
 - b. Over 6 feet to 8 feet: 2.375 inch O.D., 3.65 lb/ft.
 4. Terminal (End Pull and Corner) Posts for fabric heights:
 - a. Up to and including 6 feet: 2.375 inch O.D., 3.65 lb/ft.
 - b. Over 6 feet to 8 feet: 2.875 inch O.D., 5.70 lb/ft.
 - c. Vinyl coated or painted.
- B. Gate Posts for Swing Gates:
1. Gate fabric height up to and including 6 feet:
 - a. Gate Leaf Width:
 - 1) Up to and including 4 feet: 2.375 inch O.D., 3.65 lb/ft.
 - 2) Over 4 feet to 10 feet: 2.875 inch O.D., 5.79 lb/ft.
 2. Gate fabric height over 6 feet to 12 feet:
 - a. Gate Leaf Width:
 - 1) Up to and including 6 feet: 2.875 inch O.D., 5.79 lb/ft.
 - 2) Over 6 feet to 12 feet: 4.00 inch O.D., 9.11 lb/ft.
 - b. Vinyl coated or painted.
- C. Gate Posts for Rolling Gates:
1. As indicated on Drawings.
- D. Top and Brace Rails:
1. FS RR-F-191/3, Type II, Class 1.
 2. Size: 1.660 inch O.D., 1.806 lb. per ft.
- E. Bottom Tension Wire:
1. Coiled Spring Tension Wire:
 - a. Size: 7 gage.
 - b. Vinyl coated or painted.
- F. Fabric Connections:
1. Tension Bars:
 - a. 3/16 by 3/4 inch mild steel flats.
 - b. Vinyl coated or painted.
 2. Steel Bands:
 - a. Mild steel:
 - 1) 1/8 by 1 inch, except where otherwise indicated.
 - 2) Use 1/8 by 3/4 inch for gates.
 - b. Vinyl coated or painted.
 3. Bolts:
 - a. Minimum 3/16 inch diameter.
 - b. Cadmium plated and painted.
 4. Fabric Ties:
 - a. No.9 or No. 11 gage wire at line posts.
 - b. No.14 wire for top and brace rails.
 - c. Vinyl coated or painted.

- G. Post Caps:
1. Provide following:
 - a. Steel, wrought iron, or malleable iron, designed as weathertight closure cap.
 - b. One cap for each post.
 - c. Caps with openings to permit through passage of top rail.
 2. Finish:
 - a. Vinyl coated or painted, same as specified for posts.

2.03 GATES

- A. General:
1. Fabricate gate perimeter frames of tubular members.
 2. Provide additional horizontal and vertical members to assure proper operation of gate, and for attachment of fabric, hardware, and accessories.
 3. Space so frame members are not more than 8 feet apart.
 4. Fabricate gate frames from galvanized pipe, 1.90 inch O.D., 2.72 lb per ft.
 5. Finish:
 - a. Vinyl coated or painted.
- B. Fabrication:
1. Assemble gate frames by welding with special malleable or pressed steel fittings and rivets for rigid connections.
 2. Use same fabric as used for fence.
 3. Install fabric with stretcher bars at vertical edges as minimum.
 4. Attach hardware with rivets or by other means which will provide security against removal and breakage.
 5. Provide diagonal cross-bracing consisting of 3/8 inch diameter adjustable length truss rods on gates where required to provide frame rigidity without sag or twist.
- C. Accessible Gates:
1. Provide gates that are part of accessible route meeting requirements of CBC Section 11B-404.
 2. Provide kick plates at bottom of accessible gate complying with CBC Section 11B-404.2.10 and as detailed on Drawings.
- D. Swing Gate Hardware:
1. Hinges:
 - a. Pressed or forged steel, or malleable iron, to suit gate size; non-lift-off type, offset to permit 180 degree opening.
 - b. Provide 1-1/2 pair of hinges for each leaf over 6 feet in nominal height.
 2. Latches:
 - a. Capable of retaining gate in closed position
 - b. Provide forked type or plunger-bar type to permit operation from either side of gate.
 - 1) Provide padlock eye as integral part of latch.
 3. Double Gates:
 - a. Provide locking device and padlock eyes as an integral part of latch, requiring one padlock for locking both gate leaves.
 - 1) Complete Drop Rod Set:
 - a) Model CL-DROP-ROD-COM by Hoover Fence Company, or approved equal.

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- b. Provide cane bolt with hardware for mounting on nominal 2 inch pipe gate frame.
 - 1) Chain Link Drop Rod – Cane Bolt Type:
 - a) 30 inches long.
 - b) Model CL-CANE-BOLT by Hoover Fence Company, or approved equal.
 - 2) Guides: Chain Link Female Strap Hinge:
 - a) Model CL-FHP-2 for 2 inch pipe frame by Hoover Fence Company, or approved equal.
 - b) Provide 2 per cane bolt
 - c. Provide Centerstop secured to slab, to engage center drop rod.
 - 1) Chain Link Centerstop:
 - a) Model CL-CS-M by Hoover Fence Company, or approved equal.
 - b) Provide one for gates in closed position.
 - c) Provide one for each gate leaf in open position, when indicated.
 - 4. Padlocks: Furnished by Owner
- E. Accessible Gate Hardware:
 - 1. Self-Closing Hinges:
 - a. Heavy Duty 180 degree Gate Closer and Hinge:
 - 1) Model Mammoth-HD-ZLIV as manufactured by Locinox USA LLC, Glendale Heights, IL
 - a) Includes Raptor Hinge
 - 2) Include bracket for mounting closer to chain link fence post and gate frame:
 - a) Model CLB-Mammoth Chain Link Bracket by Locinox.
 - 3) Maximum Operating Force: 5 lbs.
 - b. Provide one gate closer for gates weighing up to 440 pounds.
 - c. Provide two gate closers for gates weighing over 440 pounds.
 - 2. Exit Devices:
 - a. Provide exit device where indicated on Drawings when gate is part of accessible path of travel for required means of egress.
 - 1) Comply with requirements of CBC, Chapter 11B.
 - b. Model PA-AX-99-NL-OP-110MD by Von Duprin.
 - 1) Furnish with Rim Cylinder for exit device and lever handle matching District Standard.
 - 2) Finish: BHMA 630
- F. Rolling Vehicle Gate Hardware and Accessories:
 - 1. Top and Bottom Track Wheels:
 - a. 5 inch diameter malleable iron wheels with steel safety guides.
 - b. Pressed steel wheels are not acceptable.
 - 2. Front Wheel Carriage – Double Wheel:
 - c. Double Wheel Carrier – Rubber Wheel:
 - 1) Heavy Duty Clamp-on:
 - a) Model 14621 by Builder's Fence Co., Inc., Fontana, CA, or approved equal.
 - b) Furnish with two 6 inch diameter rubber wheels.
 - 3. Provide padlock eyes for locking of gates.
 - 4. Provide hardware and fasteners with painted finish to match fence when not available with vinyl coating.

2.04 MISCELLANEOUS MATERIALS

- A. Concrete for Footings:
 - 1. Comply with requirements of Section 03 3000.

2.05 GALVANIZING

- A. Provide galvanized finish on steel framework and appurtenances, with not less than following weight of zinc per square foot:
 - 1. Zinc-Coated Steel Fabric:
 - a. Generally 1.2 oz. per square foot, complying with ASTM A 392, Class 1.
 - b. For 6 and 9 Gage Wire: 2.0 oz. per square foot, complying with ASTM A 392, Class 2.
 - 2. Pipe: 1.8 oz. per square foot, complying with ASTM A 392, Class 1.
 - 3. Hardware and Accessories: Comply with Table 1 of ASTM A 153.

2.06 COLOR FINISH

- A. Polyolefin (Vinyl) Coating:
 - 1. Fused and adhered vinyl coating coated using polyolefin (vinyl) coating
- B. Provide polyolefin (vinyl) coating steel framework and appurtenances, with not less than following thickness:
 - 1. Fabric:
 - a. Minimum 8 mill polyolefin (vinyl) coating over specified 9 gage galvanized core fabric.
 - 2. Fence Posts and Rails:
 - a. Minimum 10 mill polyolefin (vinyl) coating over specified galvanized pipe.
 - 3. Fence Fittings and Components.
 - a. Minimum 6 mill polyolefin (vinyl) coating over specified hot-dip galvanized material and fittings.
 - 4. Provide polyolefin (vinyl) coating on Type B fence system.
 - 5. Product and Manufacturer:
 - a. Type 1 Permafused II Commercial Color Chain-Link Fence System by Master Halco, Dallas, TX, or approved equal.
- C. Paint System:
 - 1. For painting of galvanized components not available with vinyl coated finish:
 - 2. Preparation
 - a. Clean galvanized components in accordance with one or more of following:
 - 1) SSPC-SP 1 – Solvent Cleaning
 - 2) SSPC-SP 2 – Hand Tool Cleaning.
 - 3) SSPC-SP 3 – Power Tool Cleaning.
 - 3. Priming:
 - a. Apply one coat of polymeric epoxy amine primer at 1 to 2 mils dry film thickness.
 - b. Rustbond by Carboline Company, or approved equal.
 - 4. Finish Coat:
 - a. Apply minimum of one coat of aliphatic acrylic-polyester polyurethane coating at 3 to 5 mils dry film thickness per coat.
 - b. Carbothane 133 MC by Carboline Company, or approved equal.

2.07 PERFORMANCE

- A. Wind Load:
 - 1. General:
 - a. Comply with CLFMI WLG2445 – Chain Link Fence Wind Load Guide
 - 2. Design of chain link fence with privacy slats is based on Wind Speed of 70 miles per hour, Exposure B.

PART 3 EXECUTION

3.01 INSPECTION BY INSTALLER

- A. Examine conditions, with installer present, under which fence and gates are to be installed.
 - 1. Notify Contractor in writing of conditions detrimental to proper and timely completion of Work.
 - 2. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION – GENERAL

- A. General:
 - 1. Install fence to comply with ASTM F 567.
 - 2. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
- B. Setting Posts:
 - 1. General:
 - a. Install posts at maximum 10 feet on centers unless otherwise indicated.
 - b. Set posts so that top of eye is level with top of fabric, with twist and selvage above rail.
 - 2. Setting Posts in Concrete Footings:
 - a. 12 inch diameter for corner, angle and terminal posts.
 - b. 10 inch diameter for intermediate line posts.
 - c. Overall Depth of Concrete: Minimum 36 inches.
 - d. Post Embedment: Minimum 30 inches.
 - e. Maintain footings minimum of 1 inch clear of property lines or as indicated.
 - f. Unless otherwise indicated, extend concrete footings 2 inches above grade and trowel to crown to shed water.
- C. Fabric:
 - 1. Install fabric on security side of posts unless otherwise indicated.
 - 2. Set bottom of fabric to clear ground or paving by 1/2 inch.
 - a. Fence heights given are to top of fabric.
 - 3. Secure fabric to posts with ties spaced at 16 inches maximum.
 - a. Hook tie at both ends with 9 gage wire
 - b. Wrap tie around fabric at both ends, not less than two turns with 11 gage wire.
 - c. Hooked ties with links not permitted.
 - 4. Secure fabric to top rail with 14 gage ties not more than 18 inches on center, wrapped not less than two turns.
 - 5. Secure tie ends with not less than two full twists

- a. Turn ends so as not to be a hazard.
- D. Rails:
 - 1. Top Rail:
 - a. Provide top rail for fencing.
 - 2. Brace Rails:
 - a. Provide horizontal brace rails adjacent to terminal, angle, gate and corner posts, for fencing 6 feet high or higher.
 - 1) Secure brace rails to posts with rail end fittings and rail end bands.
- E. Tension Wire and Tension Bars:
 - 1. Provide bottom tension wire throughout.
 - 2. Secure tension wire to fabric with 14 gage wire at 18 inches on center, double wrapped.
 - 3. Secure fabric at end, corner, angle and gate posts with tension bars extending full height of fence, attached to posts with bands spaced at 14 inches maximum.

3.03 GATE INSTALLATION

- A. General:
 - 1. Provide gates of sizes and types indicated.
 - 2. Install gates plumb, level, and secure for full opening without interference.
 - 3. Set gate posts in accordance with spacing shown on Drawings in concrete footings having minimum depth of 42 inches and held 6 inches from bottom of footing.
 - 4. Install ground-set items in concrete for anchorage in accordance with fence manufacturer's recommendations as approved by Architect.
- B. Rolling Vehicle Gates:
 - 1. Affix roller guides to gate posts at height even with gate top rail to hold gate in vertical position.
 - 2. Weld gate stops to end of gate or track so gate is unable to pass rollers in either direction.
 - 3. Front Wheel Carriage – Double Wheel
 - a. Double Wheel Carrier – Rubber Wheel.
 - 4. Lubricate and adjust hardware to ensure proper and smooth operation.

3.04 REPAIR

- A. Galvanized Surfaces:
 - 1. Clean field welds, bolted connections, and abraded areas.
 - a. Repair galvanizing to comply with ASTM A 780.
- B. Painted Surfaces:
 - 1. Clean bolted connections and abraded areas.
 - 2. Re-prime as necessary.
 - Apply specified finish coat as required.

3.05 CLEANING

- A. Remove rubbish, debris and waste materials and legally dispose of off Project Site.

3.06 PROTECTION

- A. Protect Work until Substantial Completion

END OF SECTION 32 3113

SECTION 32 9113

SOIL PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes planting soils specified by composition of the mixes.

1.02 DEFINITIONS

- A. Imported Soil: Soil that is transported to Project site for use.
- B. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

1.03 PREINSTALLATION MEETINGS

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

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each bulk-supplied material in sealed containers labeled with content, source, and date obtained; providing an accurate representation of composition, color, and texture.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
- B. Soil Analysis: If the contract documents do not include an agricultural suitability report, Contractor shall, after rough grading, provide for agricultural suitability testing and a written report by a qualified soil-testing laboratory. Recommendations of agricultural suitability and fertility analysis soils report, after review by agency and/or construction manager (CM), may take precedence over these specifications.
 - 1. The soil-testing laboratory shall oversee soil sampling. Quantity of test sites shall be determined by agency and/or project construction manager (CM).
 - 2. Report suitability of tested soil for plant growth.
 - a. Recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.
 - 3. Provide a soils analysis of each soil type.

PART 2 - PRODUCTS

2.01 PLANTING SOILS SPECIFIED BY COMPOSITION

- A. Planting Soils: ASTM D 5268 topsoil or existing, native surface topsoil amended with inorganic and organic soil amendments and fertilizers in specified quantities shall consist of fertile, friable soil of loamy character, and shall contain an amount of organic matter normal to the area. It shall be reasonably free from weeds, refuse, roots, heavy or stiff clay, stones larger than one inch (1") in diameter, sticks, brush, litter and other deleterious substances. Topsoil may be obtained from the site if approved by the District.
1. For bidding purposes, or in the event a Soils Analysis as described in Article 1.6 Paragraph B is not performed, the following amendments shall be uniformly cultivated into the upper eight inches (8"), per 1000 square feet, of soil by suitable equipment operated at approximate right angles in at least two (2) directions.
 - a. Nitrogen stabilized organic amendment: 4 CY
 - b. Gro Power Plus: 150 LBS
 - c. Agricultural Gypsum: 100 LBS
- B. Planting-Soil Type As designated on plans: Imported, naturally formed soil from off-site sources and consisting of sandy loam according to USDA textures; and modified to produce viable planting soil.
1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and brome grass.
 2. For bidding purposes, or in the event a Soils Analysis as described in Article 1.6 Paragraph B is not performed, the following amendments shall be uniformly cultivated into the upper eight inches (8"), per 1000 square feet, of soil by suitable equipment operated at approximate right angles in at least two (2) directions.
 - a. Nitrogen stabilized organic amendment: 4 CY
 - b. Gro Power Plus: 150 LBS
 - c. Agricultural Gypsum: 100 LBS
- C. Backfill for Plant Pits: Backfill shall be machine-mixed and approved by the Engineer prior to incorporation in planting pits. For bidding purposes, or in the event a Soils Analysis as described in Article 1.6 Paragraph B is not performed, the following amendments shall be provided
1. On-site Soil: 6 parts by volume
 2. Nitrogen stabilized organic amendment 4 parts by volume
 3. Gro Power Plus 17 pounds per CY of mix
 4. Iron Sulfate 1 pounds per CY of mix
 5. Agricultural Gypsum 10 pounds per CY of mix
 6. Retain "Planting-Soil Type" Paragraph below for manufactured planting soil produced on-site soil or off-site for use as planting soil. Revise paragraph if existing, on-site soil will be used in the manufacturing process.

2.02 INORGANIC SOIL AMENDMENTS

- A. For bidding purposes, or in the event a Soils Analysis as described in Article 1.6 Paragraph B is not performed, the following inorganic amendments shall be provided.
 - 1. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - a. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
 - b. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
 - 2. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
 - 3. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
 - 4. Perlite: Horticultural perlite, soil amendment grade.
 - 5. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
 - 6. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.03 ORGANIC SOIL AMENDMENTS

- A. Nitrogen stabilized organic amendment shall be a ground or processed wood product derived from wood of redwood, fir or cedar, treated with a non-toxic agent to absorb water quickly. Nitrogen content, based on dry weight, shall be 0.5% for redwood and 0.7% for fir and cedar. Iron content, based on dry weight, shall be 0.1%.
- B. Wood derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil or toxic materials.

2.04 FERTILIZERS

- A. Fertilizers shall comply with applicable requirements of the State Agricultural Codes and shall be packaged, first grade, commercial quality products identified as to source, type of material, weight and manufacturer's guaranteed analysis. Fertilizers shall not contain toxic ingredients in quantities harmful to human, animal, or plant life.
- B. Commercial fertilizer shall be pelleted or granular product having the chemical analysis specified herein and shall be free-flowing material delivered in original unopened containers. Use of material which becomes caked or otherwise damaged shall not be permitted.
- C. Organic base fertilizer shall be a highly concentrated humate material derived from decomposed animal, fish, and vegetable matter with humic acids and trace minerals.
- D. Iron sulfate shall be ferrous sulfate containing not less than twenty-one and one-half percent (21.5%) iron expressed as metallic iron.

PART 3 - EXECUTION

3.01 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

3.02 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

- A. Excavation: Excavate soil from designated area(s) to a depth of 8 inches (8") and stockpile until amended.
- B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- C. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
- D. Screening: remove stones larger than 1 inch in diameter.

3.03 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of eight inches (8"). Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off District's property.
- C. Mixing: Spread unamended soil to total depth eight inches (8"), but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is muddy, or excessively wet.
 - 1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
 - a. Mix lime and sulfur, if required, with dry soil before mixing fertilizer.
 - b. Mix fertilizer with planting soil no more than seven days before planting.
 - 2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place except where a different compaction value is indicated on Drawings.

- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.04 BLENDING PLANTING SOIL IN PLACE

- A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is muddy, or excessively wet.
- B. Preparation: Till unamended, existing soil in planting areas to a minimum depth eight inches (8"). Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off District's property.
- C. Mixing: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.
 - 1. Mix lime and sulfur, if required, with dry soil before mixing fertilizer.
 - 2. Mix fertilizer with planting soil no more than seven days before planting.
- D. Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 except where a different compaction value is indicated on Drawings.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: The District will engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests:
 - 1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.
- C. Soil will be considered defective if it does not pass tests.
- D. Prepare test reports.
- E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.06 PROTECTION AND CLEANING

- A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

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- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Vehicle traffic.
 - 4. Foot traffic.
 - 5. Erection of sheds or structures.
 - 6. Impoundment of water.
 - 7. Excavation or other digging unless otherwise indicated.
- C. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 32 9113

SECTION 33 1116

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings for site water lines including domestic water lines.
 - 2. Valves.
- B. Related Sections:
 - 1. Section 31 0000 – Earthwork; excavating of trenches.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- B. American Water Works Association (AWWA):
 - 1. ANSI/AWWA C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - 2. ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 - 3. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
 - 4. ANSI/AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
 - 5. AWWA C510 – Double Check Valve Backflow-Prevention Assembly.
 - 6. AWWA C511 – Reduced-Pressure Principle Backflow-Prevention Assembly.
 - 7. AWWA C606 – Grooved and Shouldered Joints
 - 8. ANSI/AWWA C900/C900a – Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
- A. Public Works Standards, Inc.:
 - 1. Standard Specifications for Public Works Construction (SSPWC):
 - a. The "Greenbook"; current edition.
 - 2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Provide data on pipe materials, pipe fittings, valves and accessories.
- B. Manufacturer's Certificate:
 - 1. Certify that products meet or exceed specified requirements.
- C. Project Record Documents:
 - 1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with utility company requirements.
- B. Preinstallation Meeting:
 - 1. Conduct preinstallation meeting one week prior to start of Work of this Section.
 - a. Require attendance by all affected installers.
- C. Sequencing:
 - 1. Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Ductile Iron Pipe: AWWA C151:
 - 1. Fittings: Ductile Iron. Standard thickness.
 - 2. Joints: AWWA C111, rubber gasket with rods.
 - 3. Jackets AWWA C105/A21.5 polyethylene jacket.
- B. PVC Pipe: AWWA C900 Class 200:
 - 1. Fittings: AWWA C111, cast iron.
 - 2. Joints: ASTM D 3139 compression gasket ring.
- C. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Water Service " in large letters.

2.02 VALVES

- A. Valves:
 - 1. Manufacturer's name and pressure rating marked on valve body.
- B. Gate Valves 3 Inches and Over:
 - 1. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends, control rod, post indicator, valve key, and extension box.
 - 2. Product: Mueller 2360 Series, Clow F-6100 Series, U.S. Pipe Metroseal 250 or approved equal.
- C. Ball Valves Up To 2 Inches:
 - 1. Brass body, Teflon coated brass ball, rubber seats and stem seals.
 - a. Tee stem pre-drilled for control rod.
 - b. AWWA inlet end.
 - c. Compression outlet with electrical ground connector, control rod, valve key, and extension box.
 - 2. Acceptable Manufacturers:
 - a. Ford, Jones, or Mueller.

- D. Check Valves, Post Indicator Valves, and Backflow Preventers:
 - 1. Per Water Company Requirements.
 - 2. Double Check Detector Assemblies (DCDA):
 - a. Conform to following:
 - 1) AWWA C510.
 - 2) Orange County DHS Approved Backflow Prevention Devices.

2.03 BEDDING AND COVER MATERIALS

- A. Bedding and Cover: As specified in Section 31 0000.

2.04 ACCESSORIES

- A. Thrust Blocking:
 - 1. Conforming to NFPA 24 A.10.8.2:
 - a. Factor of Safety 1.5, Water Pressure 200 psi, and soil bearing 2,000 pounds per square foot.
- B. Backflow Preventer:
 - 1. Complying with Water Company and Fire Department Requirements.
 - a. Zurn Wilkins Model 975XL Reduced Pressure Principle Assembly, or approved equal.
- C. Meter:
 - 1. Complying with Water Company Requirements.
 - a. Badger Meter Recordall Disc Meters Model 70
- D. Fire Department Connection (FDC):
 - 1. Provide FDC with sign to indicate type of system, address served by FDC, and pumping if greater than 150 psi.
 - 2. Lettering: Minimum 1 inch, color contrasting with background.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

- A. Refer to Section 31 0000 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.

- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories.
- D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

- A. Maintain separation of water main from sewer piping in accordance with Temecula Water and Health Department code.
- B. Group piping with other site piping work whenever practical.
- C. Establish elevations of buried piping to ensure not less than 3 ft of cover.
- D. Install grooved and shouldered pipe joints to AWWA C606.
- E. Route pipe in straight line.
- F. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- G. Slope water pipe and position drains at low points.
- H. Install trace wire 12 inches above top of pipe; reading "Water Line Below" in large blue letters.

3.05 INSTALLATION – VALVES

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.

3.06 SERVICE CONNECTIONS

- A. Provide water service to utility company requirements.

3.07 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Greenbook standard.
- B. Pressure test water piping in accordance with Water Department standards.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION 33 1116

SECTION 33 4200

STORMWATER CONVEYANCE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Storm drainage piping, fittings, and accessories.
 - 2. Connection of drainage system to municipal sewers.
 - 3. Catch basins
 - 4. Trench drains
 - 5. Plant area drains
 - 6. Paved area drainage
 - 7. Site surface drainage
- B. Related Sections:
 - 1. Section 31 0000: Earthwork: excavating trenches.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C 76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 2. ASTM C 443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 - 3. ASTM C 969 – Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
 - 4. ASTM D 1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 5. ASTM D 2729 – Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fitting.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M 252 – Standard Specification for Corrugated Polyethylene Drainage Pipe.
 - 2. AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500 MM (12- to 60- in.) Diameter.
- C. Public Works Standards, Inc.:
 - 1. Standard Specifications for Public Works Construction (SSPWC):
 - a. The "Greenbook"; current edition.
 - 2. Standard Plans for Public Works Construction (SPPWC); current edition.
- D. American Water Works Association Standards, current edition.

1.03 DEFINITIONS

- A. Bedding:
 - 1. Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Provide data indicating pipe, pipe accessories, and inlets.
- B. Manufacturer's Certificates:
 - 1. Certify that products meet or exceed municipal requirements.
- C. Manufacturer's Installation Instructions:
 - 1. Indicate special procedures required to install products specified.
- D. Field Quality Control Submittals: Document results of field quality control testing.
- E. Project Record Documents:
 - 1. Record location of pipe runs, connections, catch basins, cleanouts, manholes, and invert elevations.
 - a. Comply with requirements of Section 01 7839.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Coordination:
 - 1. Coordinate installation of storm drain with size, location and installation of service utilities.
- B. Preinstallation Meeting:
 - 1. Conduct preinstallation meeting one week prior to start of Work of this section
 - a. Require attendance by affected installers.
- C. Sequencing:
 - 1. Ensure that utility connections are achieved in orderly and expeditious manner.

1.06 REGULATORY REQUIREMENTS

- A. Conform to SSPWC code for materials and installation of Work.

PART 2 PRODUCTS

2.01 STORM DRAIN PIPE MATERIALS

- A. Provide products that comply with applicable codes.
- B. Concrete Pipe:
 - 1. Reinforced, ASTM C 76, Class II with Wall type A; mesh reinforcement; bell and spigot end joints.
- C. Reinforced Concrete Pipe Joint Device:
 - 1. Rubber compression gasket joint.
 - 2. Conforming to ASTM C 443

- D. Plastic Pipe:
 - 1. Schedule 40, Poly Vinyl Chloride (PVC) material.
 - a. Diameter as indicated.
 - b. bell and spigot style.
 - c. solvent sealed joint end.
 - d. Conforming to ASTM D 1785,

2.02 PIPE ACCESSORIES

- A. Fittings:
 - 1. Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- B. Trace Wire:
 - 1. Magnetic detectable conductor, clear plastic covering, imprinted with "Storm Drain" in large letters.

2.03 CATCH BASIN, CLEANOUT, AND AREA DRAIN COMPONENTS

- A. Catch Basin:
 - 1. Size and type as indicated.
 - 2. Materials and installation in accordance with manufacturer's specifications.
 - 3. Filter insert as indicated.
- B. Area Drain:
 - 1. Size and type in accordance with Construction Drawings.
 - 2. Materials and installation in accordance with Manufacturer's specifications.
- C. Filter Insert:
 - 1. Model and size as indicated.
 - 2. Materials and installation in accordance with manufacturer's specifications.
- D. Precast Storm Filter Manhole:
 - 1. Model and size as indicated.
 - 2. Materials and installation in accordance with manufacturer's specifications.

2.04 BEDDING AND COVER MATERIALS

- A. Bedding and Cover Materials:
 - 1. As specified in Section 31 0000.

PART 3 EXECUTION

3.01 TRENCHING

- A. Refer to Section 31 0000 for additional trenching requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION – PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated.
- B. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- C. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.
- D. Make connections through walls through sleeved openings, where provided.
- E. Install continuous trace wire 12 inches above top of pipe; coordinate with Section 31 2316.

3.03 INSTALLATION – CATCH BASINS, TRENCH DRAINS, AND CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated.
- E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with SSPWC standards.

3.05 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 4200