MANUAL & SPECIFICATIONS

Culver City High School Press Box Addition

100% Construction Documents

Presented to:

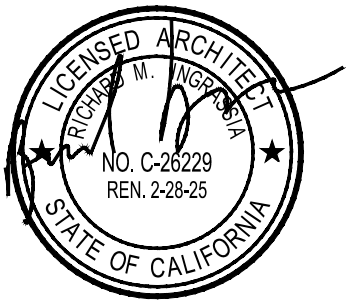
Culver City
Unified School District

4034 Irving Place
Culver City, California 90230

February 14, 2023

RACHLIN
PARTNERS

STAMP PAGE



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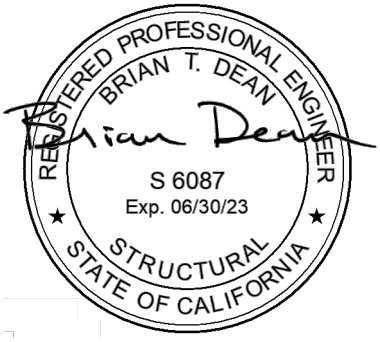

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IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-122987 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 06/20/2023

NOTE:
It is the responsibility of the Architect of Record or the Engineer of Record to ensure that all the specifications meet the minimum requirements of the current editions of the California State Titles 19 and 24. Approval of these specification does not constitute approval of or waiver of any requirements of those regulations.

SECTION 00 0002

PROJECT DIRECTORY

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PROJECT MANUAL

FOR

CULVER CITY HIGH SCHOOL
Press Box Addition

Prepared by

RACHLIN PARTNERS INCORPORATED
8640 National Boulevard
Culver City, California 90232

For

CULVER CITY UNIFIED SCHOOL DISTRICT
4034 IRVING PLACE
Culver City, California 90230

February 14, 2023

SECTION 00 0110

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DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – SITE IMPROVEMENTS

Not Used

END OF TABLE OF CONTENTS

SECTION 01 1100

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The furnishing of all labor, materials, equipment, services, and incidentals necessary for the addition of one Press Box at Culver City High School and Demolition of the existing Electrical building and an existing Crow's Nest. The addition of an asphalt walkway.

1.02 RELATED REQUIREMENTS:

1. Section 01 3113: Project Coordination.

2. Section 01 3229: Project Forms.

3. Section 01 3216: Construction Schedule.

4. Section 01 4523: Testing and Inspection.

5. Section 01 7123: Field Engineering.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 USE OF PREMISES

A. CONTRACTOR shall coordinate Work of all trades, Subcontractors, utility service providers, with OWNER and/or Separate Work Contract. CONTRACTOR shall sequence, coordinate, and perform the Work to impose minimum hardship on the operation and use of the existing facilities and/or Project site. CONTRACTOR shall install all necessary protection for existing improvements, Project site, property, and new Work against dust, dirt, weather, damage, vandalism, and maintain and relocate all protection to accommodate progression of the Work.

B. CONTRACTOR shall confine entrance and exiting to the Project site and/or facilities to routes designated by the OAR.

C. Within existing facilities, OWNER will remove portable equipment, furniture, and supplies from Work areas prior to the start of Work. CONTRACTOR shall cover and protect remaining items in areas of the Work.

D. CONTRACTOR is advised school may be in session during performance of the Work. CONTRACTOR shall utilize all available means to prevent generation of unnecessary noise and maintain noise levels to a minimum. When required by the OAR, CONTRACTOR shall immediately discontinue noise-generating activities and/or provide alternative methods to minimize noise generation. CONTRACTOR shall install and maintain air compressors, tractors, cranes, hoists, vehicles, and other internal combustion engine equipment with mufflers, including unloading cycle of compressors.

CONTRACTOR shall discontinue operation of equipment producing objectionable noise as required by the OAR.

E. CONTRACTOR shall furnish, install, and maintain adequate supports, shoring, and bracing to preserve structural integrity and prevent collapse of existing improvements and/or Work modified and/or altered as part of the Work.

F. CONTRACTOR shall secure building entrances, exits, and Work areas with locking devices as required by the OAR.

G. CONTRACTOR assumes custody and control of OWNER property, both fixed and portable, remaining in existing facilities vacated during the Work.

H CONTRACTOR shall cover and protect surfaces of rooms and spaces in existing facilities turned over for the Work, including OWNER property remaining within as required to prevent soiling or damage from dust, dirt, water, and/or fumes. CONTRACTOR shall protect areas adjacent to the Work in a similar manner. Prior to OWNER occupancy, CONTRACTOR shall clean all surfaces including OWNER property.

I. CONTRACTOR shall not use or allow anyone other than OWNER employees to use facility telephones and/or other equipment, except in an emergency. CONTRACTOR shall reimburse OWNER for telephone toll charges originating from the facility except those arising from emergencies or use by OWNER employees.

J. CONTRACTOR shall protect all surfaces, coverings, materials, and finished Work from damage. Mobile equipment shall be provided with pneumatic tires.

K. CONTRACTOR is advised OWNER will award Separate Work Contracts at this Project site.

L. CONTRACTOR shall not permit the use of portable and/or fixed radio's or other types of sound producing devices including walkmans and similar devices.

3.02 PROPERTY INVENTORY

A. Property, OWNER intends to remove; will be removed by OWNER before a room or space is vacated for the Work. Before performing Work in each room or space, OAR and CONTRACTOR shall prepare a detailed initial written inventory of OWNER property remaining within, including equipment and telephone instruments and the condition thereof. OAR and CONTRACTOR shall retain a signed copy of the inventory dated and signed by both parties. Prior to subsequent OWNER occupancy of each such room or space, OAR and CONTRACTOR shall perform a final inventory of OWNER property and all discrepancies between the initial inventory and final inventory shall be the responsibility of CONTRACTOR.

3.03 FURNITURE, FIXTURES AND EQUIPMENT (MATERIALS) OWNER FURNISHED CONTRACTOR INSTALLED (OFCI)

A. Certain materials identified in the Contract Documents as OWNER Furnished CONTRACTOR Installed, OFCI, will be delivered to the Project site by the OWNER.

B. If designated in the Contract Documents to be OWNER furnished CONTRACTOR installed, (OFCI), CONTRACTOR shall unload, store, uncrate, assemble, install, and connect OWNER supplied materials.

C. Twenty days before the date the CONTRACTOR needs to have the OFCI materials on site, CONTRACTOR shall notify OWNER of the scheduled date for needed OFCI

materials. Upon delivery to Project site, CONTRACTOR shall store OFCI materials inside rooms and/or protected spaces and will be responsible for security of OFCI materials until Substantial Completion. OAR will sign receipt or bill of lading as applicable.

D. CONTRACTOR shall, within ten days after delivery, uncrate and/or unpack OFCI materials in presence of OWNER who shall inspect delivered items. OWNER shall prepare an inspection report listing damaged or missing parts and accessories. OWNER shall transmit one copy of the report to CONTRACTOR. OWNER will procure and/or replace missing and or damaged OFCI materials, as indicated in inspection report.

E. CONTRACTOR shall install OFCI materials in the locations and orientation as indicated in the Contract Documents. CONTRACTOR shall verify exact locations with OAR before final installation of OFCI materials.

F. If required, OAR will furnish setting and or placement drawings for OFCI materials.

G. CONTRACTOR shall install OFCI materials by proper means and methods to ensure an installation as recommended by the manufacturer. CONTRACTOR shall furnish and install all necessary fasteners and required blocking to properly install OFCI materials.

H. CONTRACTOR shall install OFCI materials with manufacturer recommended fasteners for the type of construction to which the OFCI materials are being fastened and/or anchored.

I. CONTRACTOR shall provide final connections of any electrical, signal, gas, water, waste, venting and/or similar items to OFCI materials. CONTRACTOR shall, prior to final connection, verify the operating characteristics of OFCI materials are consistent with the designated supply.

3.04 FURNITURE, FIXTURES AND EQUIPMENT (Materials) - OWNER furnished, OWNER installed (OFOI)

A. Certain materials are identified in the Contract Documents as OWNER Furnished, OWNER Installed (OFOI)

B. On dates and during times designated by OWNER, CONTRACTOR shall provide clear off-loading, receiving, protected storage, and OWNER'S dumpster space areas for the use of OWNER or OWNER'S third party OFOI installation contractors. At such times, CONTRACTOR shall also make clear routes and access available to all rooms and spaces to receive OFOI materials.

C. On dates and during times designated by OWNER, CONTRACTOR shall provide access to the elevators for use of OWNER or OWNER'S third party OFOI installation contractors.

D. CONTRACTOR shall cooperate fully with OWNER or OWNER'S third part OFOI installation contractors.

E. CONTRACTOR may be requested by OWNER to provide supplemental labor and equipment to support OFOI activities. Such requests must be submitted in accordance with the change order clauses of Contract.

F. Immediately prior to mobilization of OWNER or OWNER'S third party OFOI installation contractors, OWNER shall document the condition of the Work in areas to be utilized for OFOI activities.

G. CONTRACTOR shall not be responsible for damage caused by OWNER or OWNER'S forces. OWNER shall document the condition of the Work and report to CONTRACTOR any damage in areas utilized for OFOI activities.

END OF SECTION

SECTION 01 2100

ALLOWANCES

PART 1 - GENERAL

1.01 GENERAL

A. This Section specifies administrative and procedural requirements governing Contract allowances.

1.) Allowances as set forth in the Specifications are to be used as compensation for items as set forth in this Section. The amounts listed in the schedule and/or Specifications are to be included in the base bid and shall be listed separately in the Schedule of Values and Application for Payment.

B. Type of allowances include the following:

1.) Allowance for the Relocation of Unforeseen On-Site Utilities, and Utility fees: Provide within the proposed contract sum the amount of $15,000.00 for the relocation of unforeseen on-site utilities, and utility fees to be used at the Owner's discretion. This allowance will be expended under a time and materials (T & M) basis using current prevailing wage rates, including all OH & P and mark-ups, as directed by the Architect and Owner's Representative.

2.) Allowance for the Modifications to the Path of Travel: Provide within the proposed contract sum the amount of $5,000.00 for modifications to the path of travel to be used at the Owner's discretion. This allowance will be expended under a time and materials (T & M) basis using current prevailing wage rates, including all OH & P and mark-ups, as directed by the Architect and Owner's Representative.

3.) Allowance for the Irrigation System Modifications: Provide within the proposed contract sum the amount of $5,000.00 for irrigation system modifications supporting the new work to be used at the Owner's discretion. This allowance will be expended under a time and materials (T & M) basis using current prevailing wage rates, including all OH & P and mark-ups, as directed by the Architect and Owner's Representative.

4.) Allowance for the installation of a security system: Provide within the proposed contact sum the amount of $5,000 for the installation of a security system. Contractors shall contract with the Districts consultant and coordinate the work. The allowance shall cover only the direct cost to the District's consultant. Contractors overhead and profit for the coordination of this work shall be included in the contractors bid.

1.02 RELATED SECTIONS

A. Section 01 2973: Schedule of Values
B. Section 01 2976: Progress Payment Procedure
C. Divisions 02 -33: Technical Specifications

1.03 ALLOWANCES

A. Use the allowances only as authorized for OWNER purposes and only by an approved allowance disbursement form that indicate the amounts to be charged to the respective allowance amount.

B. AT SUBSTANTIAL COMPLETION OF THE WORK, CREDIT UNUSED AMOUNTS REMAINING IN THE ALLOWANCES to the OWNER by Change Order.

1.04 ALLOWANCE DISBURSEMENT

A. CONTRACTOR shall submit a request for allowance disbursement on an allowance disbursement form. Include all substantiating and/or required data along with the request.

B. The request shall have the requested amount listed as an allowance disbursement without CONTRACTOR overhead and markup.

C. Once the OWNER has accepted the disbursement, ARCHITECT and OWNER will sign the allowance disbursement form.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALLOWANCES

A. Include in the base bid the following allowances in the amounts stated in the Specifications:

Specification Section	Description	Amount
DIVISION 22, 23, 26 & 32	UNFORESEEN UTILITIES AND FEES	$ 15,000.00
DIVISION 32	MODS TO PATH OF TRAVEL	$ 5,000.00
DIVISION 32	IRRIGATION SYSTEM MODS	$ 5,000.00
DIVISION 28	SECURITY SYSTEM	$ 5,000.00

END OF SECTION

SECTION 01 2513

PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for handling requests for substitutions submitted 30 days after the date established in the Notice of Award and pursuant to Article 6.14 of the General Conditions.

1.02 RELATED REQUIREMENTS

A. Section 01 3229: Project Forms.

B. Section 01 3300: Submittal Procedures.

C. Section 01 6000: Product Requirements.

D. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 APPLICATION

A. CONTRACTOR proposed changes in products or materials required by the Contract Documents 30 days or more after the Notice of Award are considered to be requests for substitutions. OAR will consider requests for substitution if a product is no longer manufactured or the OAR and ARCHITECT, after a diligent search have verified that product or material is not available to CONTRACTOR. The following are not considered to be valid requests for substitutions:

1. Revisions to the Contract Documents requested by OAR or ARCHITECT.

2. Specified options of products included in the Contract Documents.

3. Substitutions requested on a “or equal” basis.

3.02 SUBMITTALS

A. Transmit submittals as described in related Sections for each request for substitution.

1. Identify the product to be replaced in each request. Include related Specification Section and Drawing number.

2. Provide complete documentation denoting compliance with the requirements for substitutions, and the following information, as appropriate.

a. A detailed comparison of significant qualities of the proposed substitution with those specified in the Contract Documents. Significant qualities may

include elements, such as performance, weight, size, durability, and visual effect.

b. Product Data, including Drawings, descriptions of products, fabrication, and installation procedures.

c. Samples, where applicable or requested.

d. CONTRACTOR certification the proposed substitution conforms to requirements of the Contract Documents in every respect and is appropriate for the applications indicated.

e. CONTRACTOR waiver of rights to an increase in the Contract Amount, Milestones and/or Contract Time that may subsequently become necessary because of the failure of the substitution to adequately perform.

3. If required, ARCHITECT will request additional information or documentation for evaluation. OAR will notify CONTRACTOR of acceptance or rejection of the substitution.

4. ARCHITECT will review and consider request for substitution and provide a recommendation to OAR

5. Where a proposed substitution involves and/or affects more than one Subcontractor, CONTRACTOR shall ensure each Subcontractor cooperates with the other Subcontractor involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of all products.

6. CONTRACTOR submittal and ARCHITECT review of Shop Drawings, Product Data, material lists or Samples do not constitute an acceptable or valid request for substitution.

END OF SECTION

SECTION 01 2613

REQUEST FOR CLARIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Procedure for requesting clarification of the intent of the Contract Documents.

1.02 RELATED REQUIREMENTS

A. Section 01 1100: Summary of Work.

B. Section 01 3113: Project Coordination.

C. Section 01 3216: Construction Schedule.

D. Section 01 3229: Project Forms.

E. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PROCEDURE

A. CONTRACTOR shall prepare a Request for Clarification on the form provided in Section 01 3229. CONTRACTOR shall transmit the Request for Clarification to ARCHITECT with a concurrent copy to the OAR.

B. ARCHITECT response is a clarification of the intent of the Contract Documents and does not authorize changes in the Contract Amount, Milestones and/or Contract Time.

C. A Request for Clarification may be returned with a stamp or notation "Not Reviewed," if:

1. The requested clarification is ambiguous or unclear.

2. The requested clarification is equally available to the requesting party by researching and/or examining the Contract Documents.

3. CONTRACTOR has not reviewed the Request for Clarification prior to submittal.

D. Allow a minimum of seven days for review and response time, after receipt by ARCHITECT and OAR. CONTRACTOR shall verify and is responsible in verifying ARCHITECT and OAR receipt of a Request for Clarification.

E. Changes or alterations to the approved drawings or specifications shall be made by means of addenda or change orders as per section 4-338 of the California Building Standards Commission's, California Administrative Code.

END OF SECTION

SECTION 01 2973

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Procedure for submission of a certified Schedule of Values for review and approval by the OAR.

1.02 RELATED REQUIREMENTS

A. Section 01 2100: Allowances.

B. Section 01 2976: Progress Payment Procedures.

C. Section 01 3113: Project Coordination.

D. Section 01 3216: Construction Schedule.

E. Section 01 3229: Project Forms.

F. Section 01 3300: Submittal Procedures.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PREPARATION

A. Upon receipt of the Notice of Intent to Award, CONTRACTOR shall commence preparation of a Schedule of Values in accordance with the form included in Section 01 3229.

B. CONTRACTOR shall coordinate the preparation of a Schedule of Values with preparation of the Construction Schedule as set forth in Section 01 3213. The corresponding values from the specification division totals on cost loaded schedule shall match with the approved Schedule of Values.

C. Include the following Project identification on a certified Schedule of Values:

1. Project name and location.

2. Project Number.

3. Contract #.

4. CONTRACTOR name.

5. Date of Submittal.

D. The Schedule of Values shall be in tabular form with separate columns and shall include the following items:

1. Related Specification Section and Division.

2. Description of Work.

3. Name of Subcontractor, manufacturer or supplier.

4. Dollar value, quantity and unit of measure of each line item.

5. Percentage of Contract amount to nearest one-hundredth percent, adjusted to total 100 percent.

E. Round amounts to the nearest whole dollar; the total shall equal the Contract Amount.

F. Provide a breakdown of the Contract Amount in enough detail acceptable to OAR to facilitate continued evaluation of Application for Payment and progress reports. Coordinate with the Project Manual table of content and Schedule of Values form under Section 01 3229. Provide line items for subcontract amounts, where appropriate.

G. Provide separate line items for items in the Schedule of Values for total installed value of that part of the Work.

H. Provide separate line item for labor and material when required by the OAR.

I. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item except the amounts shown as separate line items as indicated under Schedule of Values form under Section 01 3229.

J. Temporary facilities and other cost items that are not direct cost of actual work-in-place shall be shown as separate line items as indicated under Schedule of Values form under Section 01 3229.

K. An approved certified Schedule of Values shall serve as the basis for the monthly certified Application for Payment.

L. If at any time, OWNER determines, in its reasonable discretion, that the schedule of Values does not approximate the actual cost being incurred by CONTRACTOR to perform the Work, CONTRACTOR shall prepare, for OAR approval, a revised Schedule of Values, which then shall be used as the basis for future progress payments. Without changing the Contract Amount, OWNER reserves the right to require CONTRACTOR:

1. To increase or decrease amounts within the line items in the Schedule of Values; and,

2. To conform the price breakdown to OWNER accounting practice.

3.02 SUBMITTAL

A. CONTRACTOR shall submit five certified copies of a Schedule of Values for review and approval by the OAR at least 14 days before the first Application for Payment.

B. OAR will review and if necessary, return the submitted Schedule of Values with summary comments noting items not in compliance with the requirements of the Contract Documents. CONTRACTOR shall revise the submitted Schedule of Values and return five copies within three days of receipt of summary comments.

C. Signature by OAR shall constitute acceptance of the submitted Schedule of Values.

D. An approved copy of the Schedule of Values by OAR will be transmitted to CONTRACTOR, and Inspector.

END OF SECTION

SECTION 01 2976

PROGRESS PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. This Section specifies administrative and procedural requirements for a certified Application for Payment.

1. Coordinate the certified Schedule of Values and certified Application for Payment with, but not limited to, the Construction Schedule, submittal log, and list of Subcontractors.

1.02 RELATED REQUIREMENTS:

A. Section 01 2100: Allowances.

B. Section 01 2973: Schedule of Values.

C. Section 01 3216: Construction Schedule.

D. Section 01 3229: Project Forms.

E. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 APPLICATION FOR PAYMENT

A. Each certified Application for Payment shall be consistent with previous applications and payments as reviewed by OAR, paid for by OWNER, and:

1. The initial Application for Payment and Final Application for Payment at time of Substantial Completion involve additional requirements.

B. Payment Application Times: The period of Work covered by each Application for Payment is payment date for each progress payment as specified in the General Conditions. The period covered by each Application for Payment is previous month.

C. Payment Application Forms: Use OWNER provided forms for the Application for Payment.

D. Application Preparation: Complete every entry on the form. Include execution by a person authorized to sign legal documents on behalf of CONTRACTOR. OAR will return incomplete applications without action.

E. Transmittal: Submit a minimum of four signed and original copies of each certified Application for Payment to OAR. All copies shall be complete, including releases and similar attachments.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to OAR.

F. Initial Application for Payment within 60 days of issuance of Notice to Proceed: Administrative actions and submittals, that must precede or coincide with submittal for first certified Application for Payment include, but are not limited to, the following:

1. Certified Schedule of Values.

2. Performance and payment bonds.

3. List of principal suppliers and fabricators.

4. Worker Compensation certificates, if applicable.

5. Auto Insurance, if applicable.

6. Hazardous Material Insurance Certificates, if applicable.

7. Construction Schedule.

8. Submittal Schedule.

9. Emergency Contact List.

10. Copies of authorizations and licenses from governing authorities for performance of Work.

11. Certified Payroll (Submitted directly to Labor Compliance in electronic format as specified by OWNER including hard copy).

12. Certification of Compliance with CEQA Mitigations.

G. Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of Progress Applications for Payment include, but are not limited to, the following:

1. Certified Payroll (submitted directly to Labor Compliance in electronic format as specified by OWNER including hard copy).

2. Updated and current Project Record Drawings (as-built).

3. Monthly Construction Schedule (updated, submitted and approved).

4. Approved Schedule of Values.

5. List of Subcontractors (Payments Summary).

6. Certification of Compliance with CEQA Mitigations.

H. Final Application for Payment at Substantial Completion: Following OAR issuance of certificate of Substantial Completion, submit an Application for Payment:

1. Administrative actions, submittals and/or Work that shall precede or coincide with this application include:

a. Occupancy permits and similar approvals by authorities having legal jurisdiction over Work.

b. Removal of temporary facilities and services.

c. Testing, adjusting and balance records.

d. Removal of surplus materials, rubbish, and similar elements.

e. Meter readings.

f. Start-up performance reports.

g. OWNER training and orientations.

h. Operating and maintenance instruction manuals.

i. Preliminary Warranties, guarantees and maintenance agreements.

j. Delivery of extra materials, products and or stock.

k. Change over information related to OWNER occupancy, use, operation, and maintenance.

l. Final cleaning.

m. Ensure that Work is completed.

n. Advise on shifting insurance coverage.

o. List of defective Work, recognized as exceptions to certificate of Substantial Completion.

p. Change of door locks, including keys, to OWNER system.

q. Certified Payroll (submitted directly to Labor Compliance in electronic format as specified by the OWNER including hard copy).

r. Certification that all benefit contributions due and owing to appropriate union trusts has been paid by CONTRACTOR and Subcontractors, as specified by the Project Stabilization Agreement (PSA) and Article 6.49 of the General Conditions.

s. Certification of Compliance with CEQA Mitigations.

t. Waivers and releases for CONTRACTOR.

END OF SECTION

SECTION 01 3113

PROJECT COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements necessary for coordinating Work operations including, but not limited to, the following:

1. General coordination procedures.

2. Coordination drawings.

1.02. RELATED REQUIREMENTS

A. Section 01 3216: Construction Schedule.

B. Section 01 3300: Submittal Procedures.

C. Section 01 4523: Test and Inspection.

D. Section 01 7700: Contract Closeout.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 COORDINATION

A. CONTRACTOR shall coordinate operations included in various sections of Contract Documents to assure efficient and orderly installation of each part of Work. Coordinate Work operations included under related sections of Contract Documents that depend on each other for proper installation, connection, and operation of Work, including but not limited to:

1. Schedule construction operations in sequence required where installation of one part of Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

3. Provide provisions to accommodate items scheduled for later installation.

4. Prepare and administer provisions for coordination drawings.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required in notices, reports, attendance at meetings, and:

1. Prepare similar memoranda for OAR and Separate Work Contract where coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of Work. Such administrative activities include, but are not limited to, following:

1. Preparation of schedules.

2. Installation, relocation, and removal of temporary facilities.

3. Delivery and processing of submittals.

4. Progress meetings.

5. Project closeout activities.

D. Conservation: Coordinate Work operations to assure operations are carried out with consideration given to conservation of energy, water, materials, and:

1. Salvage materials and equipment involved in performance of, but not actually incorporated into Work.

3.02 SUBMITTALS

A. Coordination Drawings: CONTRACTOR shall prepare coordination drawings to coordinate the installation of products and materials fabricated, furnished and installed by separate entities, under different parts of the Contract. CONTRACTOR shall notify OAR and ARCHITECT of all major conflicts in writing in a timely manner so that the design team can respond without construction delays. Coordination drawings shall address the following at a minimum:

1. Limitations in available space for installation or service. CONTRACTOR shall overlay plans of each trade and verify space requirements and conflicts between trades. Minor changes and adjustments that do not affect design intent shall be made by CONTRACTOR and shall be highlighted for ARCHITECT'S review.

2. Incompatibility between items provided under different trades (such as difference in voltage between equipment specified under Divisions 22 and 23 and electrical power provided under Division 26.)

3. Inconsistencies between drawings, specifications and codes (between trades and within each trade).

4. Additional items required for existing facilities construction projects shall be designed and prepared from available as-built drawings that are verified through non-invasive and non-destructive, visual observation only. CONTRACTOR shall field verify actual existing conditions during and upon completion of demolition work and incorporate findings into preparation of co-ordination drawings. Minor changes and adjustments that do not affect design intent shall be made by Sub-Contractor and shall be highlighted for OAR and ARCHITECT'S reviews.

B. Prepare coordination drawings in CAD with each trade on a separate layer, in specified color and scale. CONTRACTOR and each Subcontractor shall provide and forward reproducible copies and CAD drawing files in the order described here:

1. Structural shop drawings shall indicate location and sizes of columns, beams and other structural members, as well as wall, roof and slab penetrations, and will be provided to mechanical, electrical, low voltage and plumbing Sub-contractors for co-ordination. Structural items shall be indicated using black lines.

2. HVAC Subcontractor will indicate all ductwork, piping and equipment complete with installation and dimensioned service clearances, duct and pipe sizes, fitting types and sizes, top or bottom of duct and pipe elevations, distances of ducts, pipes and equipment from building reference points and hanger and support locations. Minor changes and adjustments that do not affect design intent shall be made by Subcontractor and shall be highlighted for OAR and ARCHITECT'S reviews. Forward drawings to plumbing Subcontractor for further co-ordination. HVAC items shall be indicated using orange lines.

3. Plumbing Subcontractor will indicate all plumbing lines, and equipment complete with installation and dimensioned service clearances, pipe sizes, fitting types and sizes, top or bottom of pipe elevations, distances of pipes and equipment from building reference points and hanger/support locations Co-ordinate with HVAC Subcontractor. Minor changes and adjustments that do not affect design intent shall be made by Sub-contractor and shall be highlighted for OAR and ARCHITECT'S reviews Upon completion drawings shall be forwarded to Fire Sprinkler Subcontractor for further co-ordination. All Plumbing items shall be indicated using blue lines.

4. Electrical and Low Voltage Subcontractors will indicate service and feeder conduit runs and other electrical equipment complete, including low voltage with installation and dimensioned service clearances, sizes, top or bottom of conduit and rack elevations, distances of conduits and equipment from building reference points and hanger and support locations. Co-ordinate with Fire Sprinkler, Plumbing and HVAC Subcontractors. Minor changes and adjustments that do not affect design intent shall be made by sub-contractors and shall be highlighted for OAR and ARCHITECT'S reviews. Upon completion drawings shall be forwarded to CONTRACTOR for further co-ordination. Electrical work shall be indicated in dark green lines. Low voltage work shall be indicated in light green lines.

5. CONTRACTOR will be responsible for the overall coordination review. As each coordination drawing is completed, CONTRACTOR will meet with OAR to review and resolve all conflicts on coordination drawings.

6. Coordination meetings will be held in Project field office of CONTRACTOR. CONTRACTOR is required to distribute Shop Drawings, cut sheets and submittals to Subcontractors where appropriate. Reviewed coordination drawings will be maintained in Project field office of CONTRACTOR. Meeting minutes shall be developed by CONTRACTOR and submitted to OAR within 5 days.

END OF SECTION

SECTION 01 3119

PROJECT MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements for Project meetings, including but not limited to, the following:

1. Job start meeting.

2. Pre-installation conferences.

3. Progress meetings.

4. Meetings as required by OAR.

1.02 RELATED REQUIREMENTS

A. Section 01 3113: Project Coordination.

B. Section 01 3216: Construction Schedule.

C. Section 01 3229: Project Forms.

D. Section 01 3300: Submittal Procedures.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 JOB START MEETING

A. In accordance with General Conditions, OAR will schedule a job start meeting before starting the Work, at a time and date determined by OAR. Meeting shall be held at the Project site or another location as determined by OAR. Meeting will be held in order to review responsibilities, procedures, and other administrative requirements contained within the Contract Documents.

B. Authorized representatives of OWNER, INSPECTOR, ARCHITECT, CONTRACTOR and other parties shall attend the meeting. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda items shall include significant items which could affect progress of the Work, including, but not limited to the following:

1. Preliminary Construction Schedule.

2. Critical work sequencing.

3. Designation of responsible personnel.

4. Identification of OAR.

5. Procedures for processing field decisions.

6. Request for Proposal.

7. Request for Clarification.

8. Construction Directive and Change Order.

9. Procedures for processing Applications for Payment.

10. Prevailing wages.

11. Submittal and review of Shop Drawings, Product Data, material lists, and Samples.

12. Preparation of project record documents.

13. Use of the Project site and/or premises.

14. Parking availability.

15. Office, work, and storage areas.

16. Equipment deliveries and priorities.

17. Safety procedures.

18. First Aid.

19. Security.

20. Housekeeping.

21. Working hours.

22. Contract Compliance Officer.

23. Insurance Services including OCIP.

24. Environmental Health and Safety.

25. Substantial Completion, Administrative Closeout and Contract Completion requirements and procedures.

26. Procedures for Mandatory Dispute and Claim Resolution.

D. OAR shall prepare and issue meeting minutes to attendees and interested parties no later than five calendar days after the meeting date.

3.02 PRE-INSTALLATION CONFERENCES

A. CONTRACTOR shall coordinate and conduct pre-installation conferences at the Project site as required by related Sections of the Contract Documents.

B. CONTRACTOR, manufacturers, and fabricators involved in or affected by the installation and its coordination or integration with other pre-ceding and/or subsequent installations of Work shall attend the meeting. CONTRACTOR shall advise OAR, INSPECTOR, and ARCHITECT of scheduled meeting dates in order to secure their attendance.

1. CONTRACTOR shall review the progress of construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:

a. Contract Documents.

b. Options.

c. Related Construction Directives and Change Orders.

d. Purchases.

e. Deliveries.

f. Shop Drawings, Product Data, and quality-control samples.

g. Review of mockups.

h. Possible conflicts.

i. Compatibility problems.

j. Time schedules.

k. Weather limitations.

l. Manufacturer’s recommendations.

m. Warranty requirements.

n. Compatibility of materials.

o. Acceptability of substrates.

p. Temporary facilities.

q. Space and access limitations.

r. Governing regulations.

s. Safety.

t. Inspecting and testing requirements.

u. Required performance results.

v. Recording requirements.

w. Protection.

2. CONTRACTOR shall record significant discussions and directives received from each conference. CONTRACTOR shall, within three (3) calendar days after the meeting date, distribute the minutes of the meeting to all concerned parties, including but not limited to, OAR, INSPECTOR, and ARCHITECT.

3.03 PROGRESS MEETINGS

A. Progress meetings will be held at the Project site at regular intervals, typically weekly, as determined by the OAR.

B. In addition to representatives of CONTRACTOR, OWNER, and ARCHITECT, each Subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of the Work shall, if requested by OAR, be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude all matters relating to the Work.

C. Failure of CONTRACTOR to be so represented at any progress meeting which is held at a mutually agreed time or for which a written notice is given, shall not relieve CONTRACTOR from abiding by any and all OAR determinations or directives issued at such meeting.

D. OAR will review and correct or approve minutes of the previous progress meeting and will review other significant items affecting progress. Topics for discussion as appropriate to the status of the Project include but are not limited to:

1. Interface requirements.

2. Construction Schedule.

3. Sequence and coordination.

4. Status of submittals / RFCs.

5. Deliveries.

6. Off-site fabrication.

7. Access.

8. Site utilization.

9. Temporary Construction Facilities and Controls.

10. Hours of work.

11. Hazards and risks.

12. Housekeeping.

13. Quality of materials, fabrication, and execution.

14. Unforeseen conditions.

15. Testing and Inspection.

16. Defective Work.

17. Construction Directive.

18. Request for Proposal.

19. Change Order Proposals and Change Orders.

20. Documentation of information for payment requests.

21. Application for Payment.

22. Other items as required or as brought forth..

23. Initial Notice of Start of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration. (of the General Conditions).

24. Final Notice of End of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration (of the General Conditions).

E. No later than three (3) calendar days after each progress meeting, OAR will prepare and distribute minutes of the meeting to each present and absent party. Include a brief summary, in narrative form, of progress, decisions, directives, actions taken, and all other issues since the previous meeting and report.

1. Schedule Updating: CONTRACTOR shall revise the Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized, and issue the revised schedule at the next scheduled progress meeting.

3.04 ADDITIONAL MEETINGS

A. OAR, upon giving notice to the intended parties and without further obligation, may require additional meetings to discuss Work and/or Project related activities.

3.05 OWNER'S RIGHT TO RECORD

A. CONTRACTOR agrees on behalf of itself and all its subcontractors that the OWNER may audiotape or videotape any meetings, training and any work at any time during the Project

END OF SECTION

SECTION 01 3216

CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Required procedures for the development of the Baseline Construction Schedule, Monthly Schedule Update, Four-Week Rolling Schedule, Recovery Schedules, Fragnets and Time Extension requests.

1.02 RELATED REQUIREMENTS

A. Section 01 1100: Summary of Work.

B. Section 01 2973: Schedule of Values.

C. Section 01 3300: Submittal Procedures.

D. Section: 01 3119: Project Meetings.

E. Section 01 4523: Testing and Inspection.

F. Section 01 7700: Contract Closeout.

1.03 SCHEDULER QUALIFICATIONS

A. CONTRACTOR shall have a scheduler with a minimum of 5 years direct experience in the development and maintenance of schedules.

B. CONTRACTOR shall submit the resume of the construction scheduler to OWNER for review and approval.

1.04 SCHEDULING SOFTWARE

A. CONTRACTOR shall utilize a computer generated schedule software program that will employ the Critical Path Method (CPM) in the development and maintenance of the construction schedule. This would include implementing one of the following software programs: Primavera P6, Primavera P3, Primavera Contractor, or SureTrak.

B. All schedule calculation rules, auto cost rules and resource calculation rules shall be in a format acceptable to OAR. When schedule calculations are performed, the “Retained Logic” setting shall be used. CONTRACTOR shall use the zero “Decimal Places” setting. Finish Milestones shall be constrained with either a “finish on or before” date or a “late finish” type constraint. No “Mandatory Finish” type constraints, no “Zero Free Float” constraints, no special hidden lag time between activities or other “float Suppression” techniques will be permitted. A schedule extending beyond Contract time or less than Contract time will not be acceptable. Rather, CONTRACTOR shall show any unused contract time as float (slack time) available to the project.

1.05 PRE-CONSTRUCTION SCHEDULING CONFERENCE

A. CONTRACTOR and CONTRACTOR Scheduler shall attend a pre-construction scheduling conference with OAR within 10 days after Notice of Award. CONTRACTOR Scheduler shall develop a construction schedule in accordance with this Specification Section. Scheduler shall cooperate with OAR and shall be available on site for monitoring, maintaining and updating schedules in a timely manner.

1.06 SUBMITTALS

A. Within seven calendar days after the effective date of the Notice to Proceed (or as stipulated in the milestones under Section 01 1216 Phasing of the Work Appendix A), CONTRACTOR shall submit to OWNER for review, a detailed Baseline Construction Schedule setting forth all requirements for complete execution of the Work. Include individual activities for the preparation of specific submittals, activities for owner review periods, activities for the procurement / fabrication period, installation activities, any applicable start-up & testing activities, and all contract milestones. With the exception of submittals and fabrication /procurement activities, each work activity shall range in duration from 1 workday minimum to a 10 workday maximum. The Scheduling system shall indicate all inter-relationships (logic ties) between the activities and shall be logically tied to all relevant milestones listed in Section 01 1216 Phasing of the Work Appendix A. CONTRACTOR shall cost load the activities with a “budgeted cost” that totals up to the Contract award value. The format shall be coordinated with Specification Section 01 2973 (Schedule of Values), Specification Section 01 3229 (Project Forms), and Specification Section 01 2976 (Progress Payment Procedures).

B. The level of detail indicated in the schedule shall be greater than that provided by Section 00 0110: Table of Contents of Contract Technical Specifications, including any Section 00 9113: Addenda. Duration and events indicated on schedule shall conform to phasing set forth in Section 01 1216 Phasing of the Work and shall show any area or building within a particular phase. Each activity description shall outline the specific work scope (by trade) and the location. Schedule shall indicate any and all Contract "milestone events" and other milestones agreed to by OWNER, but no other manually-imposed dates will be accepted unless approved by OWNER.

C. CONTRACTOR shall allow for inclement weather in the Proposed Baseline Schedule by incorporating an activity titled “Rain Day Impact Allowance” as the last activity prior to the Substantial Completion Milestone. No other activities may be concurrent with it. The Rain Day Impact Allowance activity will have a 08 calendar day Duration. On projects that have multiple phases with defined start & finish dates, the cumulative rain impact allowance may be split up (pro-rated) into their designated phases upon OAR approval. When rainfall at the Project site impacts Critical Path activities, CONTRACTOR may provide OWNER with a written request for a rain impact day describing the inclement weather delay on the Critical Path activities. The inclement weather delay must be clearly indicated by a 70 percent decrease in the field labor workforce hours on Critical Path activities on the day in question and be scheduled on an actual work day. Upon OWNER’S independent confirmation of the amount of rainfall and impact, OWNER will authorize CONTRACTOR to reduce the duration of the Rain Day Impact Allowance by one day. Rainfall on non-scheduled workdays shall not be granted as rain impact days. If the effects of rain from a non-scheduled Work day carry forward to a scheduled work day and impacts the Critical Path as noted above, then the scheduled work day will be considered impacted by rain. Any unused rain day allowance at the end of the project will be shown as available float to the Substantial Completion Milestone.

D. CONTRACTOR shall submit a color bar chart of all activities organized by Area (Location) and sorted by early start date in a graphically “left to right” manner. In addition, submit a Critical Path (Longest Path) color bar chart filter. Include the following

column headings on the left hand side of both bar chart reports: activity ID, activity description, original duration, remaining duration, percent complete, start date, finish date, total float (slack time), and budgeted cost. CONTRACTOR shall also include an electronic copy of the Schedule on a CD in an acceptable format (i.e. XER, PRX) to the OWNER.

E. Include a written schedule narrative sufficiently comprehensive to explain the basis of the CONTRACTOR'S approach to work. The written schedule narrative should include a paragraph of the project's Critical Path, the anticipated crew sizes (by trade), any planned equipment needed, a discussion on any long lead procurement/fabrication items, and any site logistic challenges.

F. Seven calendar days after receipt of the OWNER'S review comments, CONTRACTOR shall revise & re-submit the Construction Schedule acceptable to OWNER. Once the Baseline Construction Schedule is approved, no changes will be allowed unless authorized by the OWNER.

G. Failure of CONTRACTOR to submit a Construction Schedule in full compliance with the Contract Documents will result in a delay in progress payment processing. The Construction Schedule is to be used in evaluating progress and for monthly payment approval.

H. Subsequently with each Monthly Progress Payment Request, CONTRACTOR shall deliver to OWNER a Monthly Schedule Update reflecting Work progressed to the end of the Progress Payment Request period (set as the last day of the month). Each such Monthly Schedule Update shall indicate actual progress to date in execution of the Work, together with a projected schedule for completion of all the remaining Work. CONTRACTOR shall copy & re-name the schedule file each month, status the activities with actual start and/or finish dates, adjust remaining durations, add re-submittals (if applicable), calculate the schedule with a "data date" to the end of the pay period, and submit the required reports outlined in Article 1.06 to OWNER. Each Monthly Schedule Update shall be submitted con-currently with the Monthly Pay Application no later than the fifth day of the succeeding month in accordance with the General Conditions. In updating the Schedule, CONTRACTOR shall not modify Activity ID numbers, activity descriptions, original durations, logic, schedule calculation rules/criteria, or the Activity Coding unless authorized by the OAR.

I. All Schedule submittals are subject to review and acceptance by OWNER. OWNER retains the right to withhold progress payments in whole (or in part) until CONTRACTOR submits a Construction Schedule acceptable to OWNER.

1.07 FOUR-WEEK ROLLING SCHEDULE

A. At each Weekly Progress Meeting, CONTRACTOR shall present a Four-Week Rolling Schedule in Bar Chart format. It shall show one (1) week of actual and three (3) weeks of forecasted progress. The Four-Week Rolling Schedule shall be used as a basis for discussing progress and work planned during the three (3) weeks.

1. The Four-Week Rolling Schedule shall be based on the most recent OAR Accepted Monthly Schedule Update. It shall include weekly updates to all construction, submittal, fabrication and procurement, and separate work contract activities. CONTRACTOR shall ensure that it accurately reflects the current progress of the Work.

2. CONTRACTOR shall discuss at the Weekly Progress meeting the actual dates and any variances to critical or near critical activities.

3. Upon request by OAR, CONTRACTOR shall provide the Four-Week Rolling Schedule in electronic format.

4. If the Four-Week Rolling Schedule indicates activities are behind schedule, CONTRACTOR shall provide a Recovery Schedule in accordance with Article 1.08 below.

5. If the CONTRACTOR chooses to provide a Four-Week Rolling Schedule in a greater level of detail (by trade/subcontractor) outside of the monthly schedule database, then upon CONTRACTOR REQUEST and OAR written approval, the CONTRACTOR may proceed as long as the detailed activities roll-up to the contractual monthly schedule updates. These detailed activities will need to be linked to the overall Substantial Completion date as to properly forecast whether the project is ahead or behind schedule during the weekly Progress Meetings. The Four-Week Rolling Schedule must accurately reflect the work that is going on during the current week and must accurately reflect what will happen in the next three weeks.

1.08 RECOVERY SCHEDULES

A. If a Monthly Schedule Update indicates negative float greater than ten (10) days on a critical path as result of events not predicated by the General Conditions, CONTRACTOR shall prepare a Proposed Recovery Schedule demonstrating CONTRACTOR'S plan to regain the time lost. The Recovery Schedule shall be submitted either in advance of or concurrent with the Monthly Schedule Update and CONTRACTOR progress request. Both the Monthly Schedule Update and the Proposed Recovery Schedule shall be based on the same percentages of completion and actual dates accepted by OAR under Article1.06.

B. The Proposed Recovery Schedule shall be based on a copy of the Monthly Schedule Update for the calendar month during which the negative float first appears.

C. The Proposed Recovery Schedule shall include a written narrative that identifies the causes of the negative float on the critical path and provides CONTRACTOR'S proposed corrective action to ensure timely completion of all Milestones and the Substantial Completion Date. CONTRACTOR'S corrective actions shall include but are not limited to increasing concurrent operations, increasing labor, adding multiple shifts in a 24-hour period, and adding overtime.

D. During any period of time when CONTRACTOR is found to be behind schedule by OAR, the Monthly Schedule Update described above shall become a weekly requirement (at no additional cost to OWNER) to provide a greater degree of focus on the timely completion of the Work. These Updates shall be submitted to OAR every Monday morning. When CONTRACTOR is deemed by OAR to be back on schedule, CONTRACTOR may revert to submitting the schedule monthly.

E. CONTRACTOR'S progress payment may not be processed until OAR accepts the Proposed Recovery Schedule. Following such an acceptance, the Proposed Recovery Schedule will be known as the Recovery Schedule and future Work will be performed by CONTRACTOR in accordance with it.

1.09 FRAGNETS AND TIME EXTENSION REQUESTS

A. Float is not for exclusive use or benefit of either OWNER or CONTRACTOR but is an expiring resource available to both parties on a non-discriminatory basis. If required to meet specified Milestones, either party may utilize float. Adjustments to Milestones or

Contract Time will only be authorized by Change Order and only to the extent the claimed adjustments exceed total float along the most critical path of the current Monthly Schedule Update in effect at the time of the claimed adjustments. The claimed adjustments to the Milestones and/or Contract Time must also cause the Substantial Completion Date to exceed that currently indicated in the Monthly Schedule Update. No time extensions will be granted nor delay damages paid under contract until all available float is used and the CONTRACTOR obtains a Time Extension Request approval from the OAR in accordance with Article 1.12 in its entirety. CONTRACTOR claimed adjustments to an existing negative float path will not receive consideration until the activity with the highest negative float is driven even further negative.

1. Claimed adjustments to the Milestones or Contract Time will be administered in conjunction with those set forth in the General Conditions.

B. Pursuant to the float sharing requirements of this Section, the use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic restraints, and extended activity times or durations are prohibited. The use of float time disclosed or implied by the use of alternate float suppression techniques shall be proportionally shared to benefit OWNER and CONTRACTOR. The use of any technique solely for the purpose of suppressing float will result in OWNER rejection of the submitted Monthly Schedule Update.

C. In the event CONTRACTOR believes the Project has suffered an adverse impact arising from events predicated by the General Conditions, CONTRACTOR may prepare a Time Extension Request by submitting a Schedule Fragnet and a written narrative outlining the detail of the impact. A Schedule Fragnet must demonstrate a critical path delay. Such a delay must adversely impact the Substantial Completion Date for CONTRACTOR to receive a time extension. To demonstrate such an impact successfully, CONTRACTOR shall prepare a Schedule Fragnet based on a copy of OWNER accepted Monthly Schedule Update for the calendar month during which the adverse impact occurred. This “copy” of the OWNER accepted Monthly Schedule Update shall however first be updated (by OWNER and CONTRACTOR jointly) with both Percentages of Completion and Actual Dates up to the day the delay commenced. This process will provide the “pre-delay” project status. Once OWNER and CONTRACTOR have agreed to the “pre-delay” project status, CONTRACTOR should make a copy of this “pre-delay” schedule and this copy is to be the starting point for CONTRACTOR’S Schedule Fragnet development. OWNER will evaluate the activities, logic, durations, etcetera, in the Schedule Fragnet and will evaluate if the adverse impact arose from events described by Articles 10 and 12 of the General Conditions. The Fragnet shall also include CONTRACTOR-caused delays that affect the critical or near critical path in the network and should be accounted for in the Time Impact Analysis if overlapped at any point in time with OWNER-caused delay. If rain impact days were granted between the Start and Finish of OWNER-caused delay period, they should be accounted for in the Time Impact Analysis as well. Provided OWNER determines such an impact occurred, CONTRACTOR may be due a time extension equal to the number of proportioned days of variance/delay that resulted to the Substantial Completion Date.

D. Activities added into a Schedule Fragnet to demonstrate the impact of adverse event shall be assigned a unique activity code. The Schedule shall be organized by this unique activity code.

E. The Schedule Fragnet shall incorporate logic ties that are accurately reflective of the adverse event to pre-event predecessor activities and post event successor activities.

F. The format and components of a Schedule Fragnet submittal shall be in accordance with this Section and the General Conditions. It is crucial for the Fragnet to be submitted within the same month of discovery so it can be resolved during the monthly schedule

update review. The notice shall be transmitted to OAR within the stipulations outlined in the General Conditions.

G. If OWNER accepts CONTRACTOR'S Schedule Fragnet and an extension is granted, a Change Order will be prepared. OWNER will advise what change order number the time extension will become. When CONTRACTOR receives this Change Order number, all the activities added to the Schedule Fragnet shall be given Activity Identification Numbers that corresponds with the Change Order number. CONTRACTOR shall cost load the activities if required by OWNER. If resource loading is required, the resource loading shall include a breakdown of labor, material, and equipment quantities.

H. If OWNER rejects CONTRACTOR'S Schedule Fragnet in part based on improper forecast logic or activity tasks then it shall be revised accordingly to conform to OWNER'S review comments and be re-submitted. If the forecast logic and activity tasks cannot be agreed to then the pre-delay schedule outlined in Article 1.09, C shall be compared to the actual as-built data in the succeeding month of the encountering issue, event, condition, circumstance, and/or cause. The variance to the project between the pre-delay and post delay schedules shall be discussed in CONTRACTOR'S written narrative and proportioned between the different parties involved in the delay.

I. If OWNER rejects CONTRACTOR'S Schedule Fragnet in whole then CONTRACTOR may follow the procedures set forth in the General Conditions.

1.10 PAYMENT FOR SCHEDULING

A. The Work of this Section will be included as part of the bid price.

B. Preparation, revising, maintenance, and compliance with this Section and Section 01 2973 is an integral part of the Contract Documents and is specified to have a minimum value equal to 2 percent of the original Contract Amount. This amount shall be proportionally cost loaded into two activities in both the Proposed Baseline Schedule and the Schedule of Values described in Section 01 2973. One activity for the "Baseline Schedule" and the other activity for the "Monthly Schedule Update Process" as follows:

1. CONTRACTOR may allocate thirty percent (30 percent) of the total scheduling cost and place in the "Baseline Schedule" activity. It can then be billed against when the OAR accepts the Proposed Baseline Schedule as the Baseline Schedule.

2. The remaining seventy percent (70 percent) may be cost loaded into the "Monthly Schedule Update Process" activity. This amount may be billed in equal monthly increments. The amount of those increments is determined by dividing the remaining cost by the total number of months in the Contract Time. Payment of these incremental amounts is contingent upon OAR acceptance of CONTRACTOR Monthly Schedule Updates, Recovery Schedules, Four-Week Rolling Schedules, Fragnets, Time Impact Analysis, and the updated Log of Required Submittals.

3. The CONTRACTOR shall anticipate in their base contract scope that numerous Fragnets and written time impact analyses will be required during the duration of the project with the Monthly Schedule Updates. Requests for extra scheduling services will not be considered until the CONTRACTOR demonstrates that all of the costs stipulated in Article 1.10, B has been expended.

1.11 FAILURE TO COMPLY WITH REQUIREMENTS

A. At any time during the project if CONTRACTOR fails to comply with the specified requirements, OWNER reserves the right to engage independent estimating and scheduling consultants to fulfill these requirements. Upon notice to CONTRACTOR, OWNER shall assess against CONTRACTOR, incurred costs for these additional services.

B. In such an event, OWNER will require, and CONTRACTOR shall participate and provide requested information to ensure the resulting Milestones Schedule accurately reflects CONTRACTOR's plan to execute the Work in compliance with the Contract Documents. If it becomes necessary for OWNER to recommend logic or duration revisions as a result of CONTRACTOR failure to furnish acceptable data, and if CONTRACTOR has objections to the recommendations, CONTRACTOR shall provide notice to OWNER within three days and CONTRACTOR shall provide an acceptable alternate plan. If CONTRACTOR fails to so note any objections and provide an acceptable alternate plan, or if CONTRACTOR implements the recommendations of OWNER without so noting any objections, CONTRACTOR will be deemed to have waived all objections and concurred with the recommended logic/duration revisions provided by ARCHITECT and/or OWNER.

C. Submittal of any Monthly Schedule Updates are subject to review and acceptance by OWNER. OWNER retains the right, including, but not limited to the General Conditions, to withhold progress payments in whole or part until CONTRACTOR submits a Monthly Schedule Update acceptable to OWNER. If a Monthly Schedule Update is "Rejected" due to the OWNER not receiving a satisfactory schedule that accurately reflects the on-going work activities, the OWNER will mandate a separate meeting with the CONTRACTOR and approved Scheduler to remedy the non-conformance. If after the 2nd consecutive month the OWNER still has to "Reject" the monthly Schedule update due to non-conformance, then the CONTRACTOR'S Scheduler will need to be replaced at no additional cost to the OWNER. CONTRACTOR shall within one week of disapproval, propose another Scheduler who meets the required experience.

1.12 CONTRACTOR RESPONSIBILITY

A. Nothing in this Section shall be construed to be a usurpation of CONTRACTOR authority, responsibility, and obligation to plan and schedule Work as CONTRACTOR deems necessary, subject to all other requirements of the Contract Documents.

B. CONTRACTOR shall provide at all times sufficient competent labor, materials, and equipment to properly carry on Work and to insure completion of each part in accordance with Construction Schedule and within time agreed. CONTRACTOR shall involve the subcontractors, manufacturers, and suppliers in the development and periodic updating of the schedule.

1.13 RECORD DOCUMENTS / FINAL AS-BUILT SCHEDULE

A. Prior to Contract Completion of the Work, CONTRACTOR shall submit a final as-built schedule, and a time-scaled network diagram (bar chart) reflecting the actual dates of all activities. This shall be submitted prior to the final application of payment and prior to the request to release retention.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

SECTION 01 3229

PROJECT FORMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The following, but not limited to, administrative forms and documents listed in this Section are to be utilized in the administration of the Work. Upon CONTRACTOR request, OAR may approve the use of alternate forms.

B. From time to time, OWNER may release new revisions and new Project Forms. At any time during the Project, if requested by OAR, CONTRACTOR shall use the newly released Project Forms.

1.02 RELATED REQUIREMENTS

A. Division 01: General Requirements.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 FORMS

A. The following examples of forms that shall be provided by the OAR:

1. Allowance Disbursement Authorization.

2. Application for Payment (2 pages)[1].

3. Certification of Compliance with Project Stabilization Agreement and Labor Compliance.

4. Certification of Compliance with CEQA Mitigations.

5. Certificate of Substantial Completion.

6. Change Order.

7. Change Order Proposal.

8. Change Order Proposal – Compensable Delay Costs.

9. Change Order Proposal Detail Sheet.

10. Change Order Proposal Guidelines.

11. Change Order Proposal – Labor Rate Calculation Form (Request for Rate Higher Than Fully burdened Labor Rates).

[1] Application for Payment (Multiple Projects Form) is available from the OAR.

12. Conditional Waiver and Release – Final Payment.

13. Construction Directive.

14. Correction Notice.

15. Daily Construction Report.

16. Daily Time and Material Record.

17. Initial Notice of start of Issue. Event, Condition, Circumstance, or Cause of Perceived or Actual Delay, Disruption, Interference, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration.

18. Final Notice of End of Issue, Event, Condition, Circumstance, or Cause of Perceived or Actual Delay, Disruption, Interference, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration.

19. Five Day Notice.

20. List of Subcontractors.

21. Notice of Completion.

22. Notice of Partial Use or Occupancy.

23. Notice of Termination.

24. Notice to Proceed.

25. “Or Equal” Request.

26. OWNER Assessment Summary.

27. Property Inventory.

28. Request for Certification of Substantial Completion.

29. Request for Clarification.

30. Request for Proposal.

31. Request for Reduction of Retention.

32. Schedule of Values.

33. Submittal Log.

34. Substitution Request.

35. Survey of Existing Site Conditions.

36. Transmittal.

3.02 PROCEDURES

A. Allowance Disbursement Authorization: This form is used for the request and approval of Contract allowances.

B. Application for Payment: This form is used in requesting a progress payment.

C. Application for Payment (Multiple Projects): Alternate progress payment request form for contracts comprising more then one project.

D. Certification of Compliance with Project Stabilization Agreement and Labor Compliance Code Section 1776: This form is used to certify that all contributions due and owing to appropriate trust funds have been paid by CONTRACTOR and all Subcontractors, as specified by the Project Stabilization Agreement (PSA) and General Conditions Article 6.49. This form is also used to certify that CONTRACTOR has submitted all certified payroll records mandated by Labor Code 1776, and General Conditions Article 6.49.

E. Certification of Compliance with CEQA Mitigations: This form is used to certify that all CEQA requirements were complied with by CONTRACTOR.

F. Certificate of Substantial Completion: This form is used according to Article 14 of the General Conditions.

G. Change Order: This form is used to adjust the Contract Amount, Milestones or Contract Time.

H. Change Order Proposal: This form is used to communicate proposed adjustments to the Contract Amount, Milestones or Contract Time.

I. Construction Directive: This form is used to issue a Construction Directive.

J. Correction Notice: This form is used to provide notice of defective Work.

K. Daily Construction Report: This form is used to report daily Work activities and manpower levels of CONTRACTOR or Subcontractor.

L. Daily Time and Material Record: This form is used to provide daily records as set forth in Article 11.11 of the General Conditions.

M. Initial Notice of Start of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration: This form is used to provide notice as set forth in Article 12.2.1 of the General Conditions.

N. Final Notice of End of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration: This form is used to provide notice as set forth in Article 12.2.2 of the General Conditions.

O. Five Day Notice: This notice is used according to Article 15.3.2 of the General Conditions.

P. List of Subcontractors: This form is used according to Article 14.2 of the General Conditions.

Q. Notice of Completion: This form is used according to Article 14.17 of the General Conditions.

R. Notice of Partial Use or Occupancy: This form is used according to Article 14.15 of General Conditions.

S. Notice of Termination: Contractor shall submit a Notice of Termination (NOT) to the Los Angeles Regional Water Quality Control Board, LARWQCB. Provide a copy of NOT to OAR (See Section 01 7416).

T. Notice To Proceed: This form is used to establish the date of Contract Time commencement and the date Contractor is authorized to commence performance of Contractor obligations.

U. "Or Equal" Request: This form is used to submit a list of proposed "or equal" substitutions.

V. Owner Assessment Summary: This form is used for all assessments or withholds by the Owner, permitted under the Contract or required by law, including without limitation, stop notices, prevailing wage violations, liquidated damages, additional consultant services, OCIP premiums, etc.

W. Property Inventory: This form is used to establish Owner property in a space.

X. "Request for Certification of Substantial Completion": This form is used according to Article 14 of the General Conditions

Y. Request for Clarification: This form is to be used for clarification of the intent of the Contract Documents.

Z. Request for Proposal: This form is used to request a proposed adjustment in the Contract Amount, Milestones or Contract Time in response to the Work contained within the Request for Proposal.

AA. Request of Reduction of Retention: This form is used according to Article 14.8 of the General Conditions.

BB. Schedule of Values: This form is used to establish the basis of the certified Application for Payment.

CC. Submittal Log: This form is a format for the listing of the required submittals.

DD. Substitution Request: This form is used to submit proposed substitutions of materials or equipment no longer manufactured or which cannot be acquired from existing inventories.

EE. Transmittal: This form is used for transmission of items related to the Contract.

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Administrative and procedural requirements for submittals required for the Work, including but not limited to; Shop Drawings, Product Data, Samples, material lists, and quality control items.

B. Throughout the Contract Documents, the minimum acceptable quality of materials, fabrication, and execution have been defined by the name and catalog number of a manufacturer and by reference of recognized industry standards.

C. To ensure that specified products are furnished and installed in accordance with the design intent, procedures have been established for submittal of design data and for its review by ARCHITECT, OAR and others.

1.02 RELATED REQUIREMENTS

A. Section 01 2513: Product Substitution Procedures.

B. Section 01 2973: Schedule of Values.

C. Section 01 2976: Progress Payment Procedures.

D. Section 01 3113: Project Coordination.

E. Section 01 3216: Construction Schedule.

F. Section 01 3229: Project Forms.

G. Section 01 4523: Testing and Inspection.

H. Section 01 7123: Field Engineering.

I. Section 01 7329: Cutting and Patching.

J. Section 01 7700: Contract Closeout.

K. Section 01 7836: Warranties.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 PROCEDURES

A. CONTRACTOR is required to review and approve every submittal and shop drawing prior to transmittal and delivery to ARCHITECT. Should CONTRACTOR determine a submittal contains errors, or does not meet the requirements of the contract, CONTRACTOR shall immediately return the submittals and shop drawings to the producer and expedite the corrections prior to transmitting the submittal to ARCHITECT. Submittals shall not be used by CONTRACTOR to request clarifications or submit questions. CONTRACTOR will affix

stamp to each submittal certifying CONTRACTOR has performed, at minimum, the following:

1. Verified the submittal is complete in all respects and follows the requirements of the Contract Documents without variance.

2. Confirmed that no substitutions have been included. If substitutions are included, CONTRACTOR shall eliminate them from the submittal and process them in accordance with Section 00 7000 General Conditions Article 6.14.

3. Identified any variances from the requirements of the Contract Documents and confirmed that the identified variance meets, but does not exceed the allowable limitations or tolerances as defined in these specifications.

4. Verified that all submitted materials, dimensions and tolerances are compatible with existing or planned conditions of the Work in order to erect, fabricate, or install the submitted assembly in conformance with the requirements of the Contract Documents.

5. Coordinated and verified that the dimensions match CONTRACTOR measured field or installation conditions.

6. Coordinated and verified that the products of separate manufacturers required within any field produced assembly are compatible in all respects for such assembly.

7. Packaged together all related submittals or shop drawings where such is necessary for a comprehensive ARCHITECT review.

B. CONTRACTOR shall package each submittal appropriately for transmittal and handling. Transmittal format shall be as required by OWNER. CONTRACTOR shall transmit and deliver six sets of each submittal or re-submittal to ARCHITECT, two of which shall be returned to CONTRACTOR. Some specifications may require additional copies be provided. CONTRACTOR shall provide the OWNER additional copies as specified or as requested by OAR. ARCHITECT will not accept submittals received from sources other than from CONTRACTOR.

C. After ARCHITECT'S review, ARCHITECT will transmit submittals to OAR and OAR shall further distribute to CONTRACTOR, INSPECTOR and others as required. Work shall not commence, unless otherwise approved by OAR, until approved submittals are transmitted to CONTRACTOR.

D. CONTRACTOR shall clearly identify any deviations from the Contract Documents on each submittal. Any deviation not so noted even though stamped reviewed is not acceptable.

E. CONTRACTOR shall coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities requiring sequential activity.

F. Timing of Submittals:

1. In accordance with General Conditions, CONTRACTOR shall submit to ARCHITECT, with copy of transmittal to the OAR, those Shop Drawings, Product Data, diagrams, materials lists, Samples and other submittals required by the Contract Documents.

2. The scheduling of submittals shall be sequenced to support the progress of the Work, and shall be:

a. Submitted sufficiently in advance of construction, fabrication or installation in order to allow time for transmittal, review, modification, correction, (and resubmission and re-review when required.)

b. Phased with adequate time between submittals in order to allow for proper review by the ARCHITECT without negative impact to the Milestones Schedule.

3. CONTRACTOR shall coordinate submittal of related items and ARCHITECT reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received by ARCHITECT.

4. CONTRACTOR shall revise, update and submit submittal schedule to ARCHITECT and OAR on the first of each month, or as required by OAR.

5. CONTRACTOR shall allow in the Construction Schedule, at least sixteen days for ARCHITECT review following ARCHITECT receipt of submittal. For mechanical, plumbing, electrical, low voltage, fire sprinklers, door and hardware, and other submittals requiring joint review with OAR, CONTRACTOR shall allow a minimum of eighteen days following ARCHITECT receipt of submittal. Deferred approval items shall be allowed additional time for DSA review.

6. No adjustments to the Contract Time or Milestones will be authorized because of a failure to transmit submittals to ARCHITECT sufficiently in advance of the Work to permit review and processing or where CONTRACTOR fails to provide ARCHITECT submittals on related items.

7. In case of product substitution, Shop Drawing preparation shall not commence until such time as OWNER accepts or rejects the proposed substitution in accordance with the procedures described in the General Conditions.

G. If required, resubmit submittals in a timely manner. Resubmit as specified for initial submittal but identify as such. Review times for re-submitted items shall be as per the time frames for initial submittal review.

H. Shop Drawing preparation shall not commence until such time as CONTRACTOR receives Product Data acceptance.

I. ARCHITECT will stamp each submittal with a uniform, action stamp. ARCHITECT will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When ARCHITECT marks a submittal “Reviewed” the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

2. Final-But-Restricted Release: When ARCHITECT, or authorized agent, marks a submittal “Reviewed as Noted,” the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

3. Returned for Re-submittal: When ARCHITECT, or authorized agent, marks a submittal “Rejected, Revise and Resubmit,” do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat as necessary to obtain different action mark. In case of multiple submittals covering same items of Work, CONTRACTOR is responsible for any time delays, schedule

disruptions, out of sequence Work, or additional costs due to multiple submissions of the same submittal item. Do not use, or allow others to use, submittals marked “Rejected, Revise and Resubmit” at the Project site or elsewhere where Work is in progress.

4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, ARCHITECT, or authorized agent, will return the submittal marked “Action Not Required “.

3.02 SHOP DRAWINGS

A. Shop Drawings are original drawings prepared by CONTRACTOR, Sub-contractor, supplier, or distributor illustrating some portion of Work by showing fabrication, layout, setting, or erection and shall not be based on reproduced Contract Documents or copied standard information.

B. Produce Shop Drawings to an accurate scale that is large enough to indicate all pertinent features and methods. Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.

C. Shop Drawings shall include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:

1. Dimensions.

2. Identification of products and materials included by sheet and detail number.

3. Compliance with specified standards.

4. Notation of coordination requirements.

5. Notation of dimensions established by field measurement.

D. Provide a space of approximately 4 by 5 inches on the label or beside the title block on Shop Drawings to record CONTRACTOR and ARCHITECT review, and the action taken. Include the following information on the label for processing and recording action taken:

1. Project name.

2. Date.

3. Name and address of ARCHITECT.

4. Name and address of CONTRACTOR.

5. Name and address of Subcontractor.

6. Name and address of supplier.

7. Name and address of manufacturer.

8. Name and title of appropriate Specification section.

9. Drawing number and detail references, as appropriate.

E. Unless otherwise agreed to or indicated in individual Specification sections, submit a sufficient number of sets to allow for adequate distribution to CONTRACTOR, Sub-Contractor, supplier, manufacturer and fabricators plus four (4) sets (two sets to be retained by ARCHITECT, one set to the INSPECTOR and one set to OAR).

3.03 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of Work or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, wiring diagrams, schedules, illustrations, or performance curves.

1. Mark each copy to show or delineate pertinent materials, products, models, applicable choices, or options. Where Product Data includes information on several products that are not required, clearly mark copies to indicate the applicable information. Include the following information:

a. Manufacturer's printed recommendations.

b. Compliance with trade association standards.

c. Compliance with recognized testing agency standards.

d. Application of testing agency labels and seals.

e. Notation of dimensions verified by field measurement.

f. Notation of coordination requirements.

g. Notation of dimensions and required clearances.

h. Indicate performance characteristics and capacities.

i. Indicate wiring diagrams and controls.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed by CONTRACTOR.

C. Required Copies and Distribution: Same as denoted in Article 3.02.E.

3.04 SAMPLES

A. Procedure:

1. Submit Samples of sufficient size, quantity, cured and finished and physically identical to the proposed product or material. Samples include partial or full

sections or range of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches denoting color, texture, and/or pattern.

a. Mount or display Samples in the manner to facilitate review of qualities indicated. Include the following:

1) Specification section number and reference.

2) Generic description of the Sample.

3) Sampling source.

4) Product name or name of manufacturer.

5) Compliance with recognized standards.

6) Availability and delivery time.

2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

a. Where variations in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show the approximate limits of the variations.

b. Refer to other Specification sections for requirements for Samples that illustrate materials, fabrication techniques, assembly details, connections, operation, and similar construction characteristics.

c. Refer to other sections for Samples to be returned to CONTRACTOR for incorporation into the Work. Such Samples must be undamaged at time of installation. On the transmittal indicate special requests regarding disposition of Sample submittals.

d. Samples not incorporated into the Work, or otherwise not designated as Owner property, remain the property of CONTRACTOR and shall be removed from the Project site prior to Substantial Completion.

3. Color and Pattern: Whenever a choice of color or pattern is available in a specified product, submit accurate color chips and pattern charts to OAR for review and selection.

4. Number Required: Submit six, minimum, of each. Two will be returned to CONTRACTOR.

B. When specified, erect field Samples and mock-ups at the Project site to illustrate products, materials, fabrications, or execution and to establish standards by which completed Work shall be judged.

C. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of the Work. Sample sets may be used to obtain final acceptance of the Work associated with each set.

3.05 QUALITY CONTROL SUBMITTALS

A. Submit quality control submittals, including design data, certifications, manufacturer's field reports, and other quality control submittals as required under other sections of the Contract Documents.

B. When other sections of the Contract Documents require manufacturer's certification of a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

C. Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the represented company.

D. Requirements for submittal of inspection and test reports are specified in other sections of the Contract Documents.

END OF SECTION

SECTION 01 4523

TESTING AND INSPECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Testing and inspection services to meet requirements of the California Building Code (CBC).

C. Tests of materials are required by a DSA certified testing agency as set forth in Section 4-335 of the California Building Standards Commission's, California Administrative Code.

1.02 RELATED REQUIREMENTS

A. Section 01 3113: Project Coordination

B. Section 01 3216: Construction Schedule

C. Section 01 3229 - Project Forms

D. Section 01 3300: Submittal Procedures

E. Section 01 6000 - Product Requirements

F. Section 01 7329 - Cutting and Patching

G. Section 01 7700 - Contract Closeout

H. Section 01 7836 - Warranties

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION

3.01 TESTS

A. OWNER will select and provide an independent DSA certified testing agency (the agency) to conduct tests, sampling, and testing of materials. Selection of material to be tested shall be by the agency and not by CONTRACTOR.

B. Any material shipped from the source of supply prior to having satisfactorily passed such testing and inspection, or prior to the receipt of notice from PI such testing and inspection is not required, shall not be incorporated into the Work.

C. OWNER will select, and directly reimburse, the agency for costs of all DSA required tests and inspections; however, the agency but may be reimbursed by CONTRACTOR for such costs as specified or noted in related sections of the Contract Documents.

D. The independent testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.

E. The agency shall not perform any duties of CONTRACTOR.

F. CONTRACTOR shall provide an insulated curing box with the capacity for twenty concrete cylinders and will relocate said box and cylinders as rapidly as required in order to provide for progress of the Work.

3.02 TEST REPORTS

A. Test reports shall include all tests performed, regardless of whether such tests indicate the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations, when and as required, shall also be reported. Reports shall indicate the material (or materials) was sampled and tested in accordance with requirements of CBC, Title 24, Parts 1 and 2, as indicated on the Drawings. Test reports shall indicate specified design strength and specifically state whether or not the material (or materials) tested comply with the specified requirements.

3.03 VERIFICATION OF TEST REPORTS

A. Each testing agency shall submit to the Division of the State Architect, in duplicate, a verified report covering all tests required to be performed by that agency during the progress of the Work. Such report, covering all required tests, shall be furnished prior to Substantial Completion and/or, when construction on the Work is suspended, covering all tests up to the time of Work suspension.

3.04 INSPECTION BY OWNER

A. OWNER, and its representatives, shall have access, for purposes of inspection, at all times to all parts of the Work and to all shops wherein the Work is in preparation. CONTRACTOR shall, at all times, maintain proper facilities and provide safe access for such inspection.

B. OAR shall have the right to reject materials and/or workmanship deemed defective Work and to require correction. Defective workmanship shall be corrected in a satisfactory manner and defective materials shall be removed from the premises and legally disposed of without charge to OWNER. If CONTRACTOR does not correct such defective Work within a reasonable time, fixed by written notice and in accordance with the terms and conditions of the Contract Documents, OWNER may correct such defective Work and proceed in accordance with related Articles of the Contract Documents.

C. CONTRACTOR is responsible for compliance to all applicable local, state, and federal regulations regarding codes, regulations, ordinances, restrictions, and requirements.

3.05 PROJECT INSPECTOR

A. A Project Inspector shall be employed by OWNER in accordance with requirements of Title 24 of the California Code of Regulations with their duties specifically defined therein. Additional DSA certified inspectors may be employed and assigned to the Work by OWNER in accordance with the requirements of California Building Standards Commission's, California Administrative Code with their duties as specifically defined in Section 4-333(b).

B. Inspection of Work shall not relieve CONTRACTOR from any obligation to fulfill all terms and conditions of the Contract Documents.

C. CONTRACTOR shall be responsible for scheduling times of inspection, tests, sample taking, and similar activities of the Work.

3.06 TESTS AND INSPECTIONS

The following tests and inspections do not limit inspection of the Work but are required by DSA, other agencies, or are required in related Sections of the Contract Documents.

Also see the DSA form 103 – Listing of Structural Tests & Special Inspections – 2022 CBC

A. Concrete - CBC, Chapter 19A:

1. Materials:

	a.	Test of Materials	1903A.1 – ACI 318
	b.	Portland Cement Tests	1916A.1 – ASTM C 150
	c.	Concrete Aggregate	1903A.5 – ACI 318
	e.	Reinforcing Bars	1916A.2
	g.	Structural Steel, Steel Pipe or Tubing	1906A.3
	h.	Admixtures	1904A.4

2. Quality:

	a.	Proportions of Concrete	1905A.2
	b.	Mixing and Placing	1905A.8 to; 1905A.12;
	c.	Concrete Testing	1905A.6.3 to 1905A6.5

3. Inspection:

	a.	Project Site Inspection	1905A.1
	b.	Batch Plant or Weigh-master Inspection	1704A.4.2
	e.	Reinforcing Bar Welding Inspection	1704A.3.1.4

B. Masonry - CBC, Chapter 21A:

1. Materials:

	a.	Masonry Units	2103A.1,2,3,4,5,6,7
	b.	Portland Cement	2103A.10.1; 2103A.10.2
	c.	Mortar & Grout Aggregates	2103A.12.3
	d.	Reinforcing Bars	2103A.13

2. Quality:

	a.	Portland Cement Tests	2105A.2.2
	b.	Mortar & Grout Tests	2105A.2.2.1.4
	c.	Masonry Prism Tests	2105A.2.2.2; 2105A.2.2.3
	d.	Masonry Core Tests	2105A.4
	e.	Reinforcing Bars	2103A.13

3. Inspection:

	a.	Reinforced Masonry	1704A.5
	b.	Reinforcing Bar Welding Inspection	1704A.3.1.3

C. Steel - CBC, Chapters 17A & 22A:

1. Materials:

a.	Structural Steel	2205A.1
b.	Material Identification	2203.A.1

2. Inspection and Tests:

a.	Test of Structural Steel	1704A.3
	Table 1704A.3.	
b.	Tests of High Strength Bolts,	1704A.3.3; 2212.A.1
c.	Tests of End Welded Studs	2212A.2
d.	Shop Fabrication Inspection	1704A.3.1.4
e.	Welding Inspection	1704A.3.1.4
f.	High Strength Bolt Inspection	1704A.3.3
g.	Steel Joist Load Tests	1703A.3.2.1
h.	Spray applied fire resistance materials	1704A.12

D. Exterior Wall Coverings - CBC, Chapter 14A, 25A:

1. Materials:

a.	Portland Cement Plaster	2512

3.07 TESTING AND INSPECTION REQUIREMENTS FOR SCHOOL CONSTRUCTION

I. <u>TESTS</u>

The owner will select an independent testing laboratory to conduct the tests. Selection of the material required to be tested shall be by the laboratory or the Owner's representative and not by the Contractor.

The contractor shall notify the Owner's representative a sufficient time in advance of the manufacture of material to be supplied by him under the Contract Documents, which must by terms of the contract be tested, in order that the owner may arrange for the testing of same at the source supply.

Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the Job.

The Owner will select and pay testing laboratory costs for all tests and inspections but may be reimbursed by the contractor for such costs under the Contract documents.

II. TEST REPORTS

One copy of all test reports shall be forwarded to the Division of the State Architect by the testing agency. Such reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of Title 24 and with the approved specifications. Test reports shall show the specified design strength. They shall also state whether or not the material or materials tested comply with requirements.

III. VERIFICATION OF TEST REPORTS

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

IV. INSPECTION BY THE OWNER

The Owner and his representatives shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.

The Owner shall have the right to reject materials and workmanship, which are defective, or to require their corrections. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the Owner. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the Owner may correct same and change the expense to the Contractor.

Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of the work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor, and materials. If such work is found to be defective in any respect due to the fault of the Contractor or his subcontractor, he shall defray all expenses to such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

V. INSPECTOR – OWNER'S

A DSA certified Project Inspector and Special Inspector shall be employed by the Owner in accordance with the requirements of the California Code of Regulations, Title 24, Part 1, will be assigned to the work. His duties are specifically defined in Section 4-342 of Title 24, Part 1.

The work of construction in all stages of progress shall be subjected to the personal continuous observation of the Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the material. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.

VI. INSPECTOR – OWNER – FIELD OFFICE

The Contractor shall provide for the use of the Owner's Inspector a temporary office to be located as directed by the Inspector and to be maintained until removal is authorized by the Owner. This office shall be substantial waterproof construction with adequate natural light and ventilation by means of stock design windows. The door shall have a lock. A table satisfactory for the study of plans and two chairs shall be provided by the contractor. The Contractor shall provide and pay for adequate electric lights, private local telephone service with a loud exterior bell, and adequate heat for this field office until the completion of the Contract.

END OF SECTION

SECTION 01 4524

IMPORT MATERIALS TESTING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for the sampling, testing, transportation and certification of imported fill materials to school sites.

B. This Specification defines:

1. CONTRACTOR requirements for use of imported materials on project sites.

2. CONTRACTOR requirements for stockpiling materials for use on project sites.

3. Testing requirements for all materials imported, stockpiled or generated for use on a project site.

4. CONTRACTOR testing and reporting requirements.

5. CONTRACTOR submittal requirements

C. Provisions of the General Conditions and Division 01 apply to this section.

1.02 OBJECTIVES

A. Ensure that fill materials imported to project sites are safe for students, staff and visitors.

B. Ensure that representative data be collected so that analytical determinations can be made in regard to the first objective.

C. Require CONTRACTOR to contract with and pay for the services of a licensed environmental professional (licensed State of California Professional Engineer [PE Civil], Professional Geologist [PG] or Registered Environmental Assessor II [REA II]) familiar with environmental site assessment and waste classification.

D. Require CONTRACTOR to contract with and pay for an independent, approved California Department of Health Services certified testing laboratory to perform sampling and testing of imported and site generated fill materials.

E. Require CONTRACTOR to pay all fees required by authorities having jurisdiction over area.

F. Require CONTRACTOR to post bonds required by authorities having jurisdiction over area.

1.03 SUBMITTALS

A. CONTRACTOR shall submit to OWNER'S Authorized Representative (OAR):

1. A qualifications statement for CONTRACTOR's independent California certified testing laboratory and required licensed environmental professional (California Professional Engineer [PE civil]), Professional Geologist [PG] or Registered Environmental Assessor II [REA II]) prior to the start of Work. CONTRACTOR's licensed environmental professional must possess recent demonstrated environmental experience in soil sampling and waste classification.

a. Testing laboratory must be pre-approved by the Division of State Architect.

2. A draft import Sampling Strategy Plan (SSP) prepared by CONTRACTOR's licensed environmental professional for review and concurrence by the OAR. The objective of the SSP is to obtain representative sample data. The Draft SSP must be submitted at least 72 hours prior to all proposed import sampling activities.

   a. At a minimum, the Draft SSP shall include a site map which shows the location of the proposed import and the location and number of the proposed stockpile samples. The draft SSP shall also contain information pertaining to the total volume of the stockpile proposed for sampling and the rationale in support of the proposed sampling approach. Existing environmental documentation specific to the import site shall be utilized by the CONTRACTOR's environmental professional to support the proposed sampling approach and analytical method suite. For new project sites, this information would include a DTSC approved site investigation report, e.g., Preliminary Environmental Assessment (PEA). It is the responsibility of the CONTRACTOR to request this information in advance from the OAR if they do not already have access to a copy at the jobsite.

   b. Lacking this information or rationale, samples shall be analyzed for all analytical methods described in Section 3.01. Guidance for the minimum number of samples per stockpile volume is provided in Table 1 (supplemental samples may be required by the OAR if pothole stockpile sampling is utilized.). In addition, the draft SSP shall contain all necessary contact information for the import site and a proposed schedule for the sampling activities.

   c. To expedite the review process, the Draft SSP shall be submitted electronically to the OAR in MS WORD format.

   d. Upon revision of the draft SSP by the CONTRACTOR's licensed environmental professional and acceptance by the OAR, four revised copies of the final SSP will be provided to the OAR for distribution to OEHS and the project file.

3. A draft Certification/Sample Data Report prepared by CONTRACTOR's licensed environmental professional for review and concurrence. At a minimum the draft Certification/Sample Data Report shall contain:

   a. a site map showing the location of the stockpile and stockpile sample locations;

   b. a detailed discussion and evaluation of the laboratory results;

   c. a summary of findings and recommendations that provide a determination on the waste classification of the subject materials, based on the representative sample results;

   d. recommendations for additional steps, if any;

   e. a chain-of-custody forms and all laboratory data with respective QA/QC sheets.

   f. To expedite the review process, the Draft SSP shall be submitted electronically to the OAR in MS WORD format.

g. Upon revision of the draft Certification Report by the CONTRACTOR'S licensed environmental professional and acceptance by the OAR, three copies of the final report will be submitted to the OAR.

4. The Environmental Compliance Manager shall confirm that the proposed waste classification for the proposed import material is appropriate.

5. Written documentation, in the form of a memo or e-mail from CONTRACTOR to OAR, prior to import, verifying that the hauling contract specifies "clean" trucks and that the actual haul trucks utilized for import activities will be clean of visible contamination or deleterious materials.

6. Written documentation that the trucks went directly from the source location to the recipient location with no detours or stops at other locations and that short loads were not augmented by other materials that were not tested as part of the final import SSP. It is the CONTRACTOR's responsibility to document that no other trips or short-load augmentation occurred and submit to the documentation within five (5) business days of the completion of the import activities. All import transportation activities shall be conducted in accordance with all applicable (local, State, Federal) rules and regulations.

7. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the IOR, Architect, OAR, DSA, Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the DSA. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to DSA as required by Title 24, CCR.

8. Certification, in the form of haul tickets or completed waste manifests, documenting the volume and recipient of all import materials and activities. This documentation shall be coordinated through the OAR Environmental Compliance Manager.

   a. For approved import to new project sites, unregulated facilities (landfill) or non-project sites, haul tickets may be utilized, but shall contain the following minimum information:

      1) date of haul activity

      2) address of source

      3) address of recipient

      4) load volume

      5) time of departure from source

      6) time of arrival at recipient site

      7) signature of recipient or recipient's agent

1.04 APPROVALS

A. NO import of earth or geotechnical grading or fill materials can occur at the project site without PRIOR approval by the OAR.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Imported

1. Soils: Soils proposed for import shall be tested pursuant to the requirements of this Section.

2. Gravels: Clean gravel, consisting of native rock from a commercial source, shall be tested pursuant to the requirements of this Section. Refer to Item 2.01.B, this Section, for the list of pre-tested sites

3. Sands: Clean sand from a commercial source shall be tested pursuant to the requirements of this Section. CONTRACTOR shall provide written documentation, which identifies the source, volume and proposed transport date(s) of the material for review. Refer to Item 2.01.B, this Section, for the list of pre-tested sites:

4. Miscellaneous Material: No miscellaneous material containing crushed concrete, asphalt, construction debris, or other potential deleterious materials may be utilized or imported to the project site for use as fill or grading material.

B. Pre-Tested Sites:

Vulcan Materials Company
1709 Sherbon Street
Corona, CA 92879
Materials Tested: Sand, CAB, and 3/4 " Rock

LB Crushing Company
3100 Horseless Carriage Road
Norco, CA
Materials Tested: Sand

El Toro Materials
Rocky Road & Portola Parkway
Lake Forest, CA
Materials Tested: Sand

Hanson Aggregates North America-Inland Plant
12000 Banyan Street
Rancho Cucamonga CA 91730
Materials Tested: Sand

Hanson Aggregates North America-Irwindale
13550 Live Oak Avenue
Irwindale, CA 91706
Materials Tested: Sand

Inland Empire Regional Composting Authority (IERCA)
12645 Sixth Street
Rancho Cucamonga, CA 91739
Materials Tested: Top Soil and Mulch

C. Import of fill Materials:

1. Fees: CONTRACTOR shall pay as required by authorities having jurisdiction over area.

2. Bonds: CONTRACTOR shall post as required by authorities having jurisdiction over area.

PART 3 - EXECUTION

3.01 GRADING/EXCAVATION

A. If the Contractor encounters an area(s) with discolored, stained, and/or odorous soils or any other evidence of contamination during excavation/grading work, Contractor must immediately notify District Representative, cease work in the aforementioned area(s), and secure the area(s) with fencing, tape, stakes or other suitable means to prevent entry by personnel or equipment. In turn, the District Representative which will initiate a construction response to address the contamination, in accordance with pertinent regulatory requirements.

3.02 SAMPLING AND TESTING

A. CONTRACTOR shall contract with, and pay for, the services of a licensed environmental professional (licensed State of California Professional Engineer [PE Civil], Professional Geologist [PG] or Registered Environmental Assessor II [REA II]).

B. CONTRACTOR shall contract with, and pay for, an independent, approved California Department of Health Services certified testing laboratory to perform sampling and testing of imported and site generated fill materials. [Note: Utilization of portable, onsite crushing equipment on the project site also requires prior notification and approval by the OAR].

C. All imported fill/grading material, unless otherwise specified in writing by the OAR, must be tested at the site of origin. Import testing and certification process shall include the following steps:

1. Stockpile all materials for sampling (standard stockpile or backhoe pothole stockpile). Crushed fill materials generated by CONTRACTOR at a project site must be segregated by material (e.g., separate stockpiles for concrete, asphalt, etc.).

2. Submit Draft SSP for review and concurrence by OAR.

3. Collect and analyze samples (see Table 1 for number of samples per volume) per SSP. Once fill materials for export have been stockpiled and tested, they may not be used onsite for any purpose without prior approval by the OAR.

4. Submit draft import sample data report for review and concurrence by the OAR.

5. Submit final import sample data report (Certification Report) to the OAR's Environmental Compliance Manager for concurrence of proposed waste classification.

6. Submit required pre import documentation/record to the OAR (e-mail).

7. Submit post import certifications to the OAR.

8. In addition to the preceding, requirements, certifications and submittals as indicated in previous subsections above.

D. OWNER retains the right to refuse any fill material proposed for use at a project site.

E. Import fill materials shall be stockpiled by CONTRACTOR and are deemed acceptable for import or reuse only when it is demonstrated to the satisfaction of the OAR's

Environmental Compliance Manager that the subject materials meet the requirements of this Section (01440).

F. As described in Section 1.03B, lacking site-specific data or sample rationale to support a more focused analytical approach; the CONTRACTOR shall analyze all samples for the following substances according to the methods indicated below. Table 3 is a waste classification flowchart for use by CONTRACTOR's environmental professional. In all cases, detection levels and quality assurance/quality control methods shall be in accordance with standard Method reporting limits and best laboratory practices and the following USEPA (EPA) methods:

1. Total Petroleum Hydrocarbons, utilizing EPA Method 8015M, for gasoline and diesel.

2. Volatile Organic Compounds, utilizing EPA Method 8260B/5035.

3. Polychlorinated biphenyls, utilizing EPA Method 8082.

4. Semi-Volatile Compounds, utilizing EPA Method 8270C.

5. Organochlorine Pesticides, utilizing EPA Method 8081A.

6. Organophosphorous Pesticides, utilizing EPA Method 8141A.

7. Chlorinated Herbicides, utilizing EPA Method 8151A.

8. California Code of Regulations Title 22 (CAM 17) Metals, utilizing EPA Method 6010B/7470A.

9. Hexavalent Chromium, utilizing EPA Method 7199.

10. Arsenic/Thallium, utilizing EPA Method 6020.

G. Import fill material may be deemed defective for use by the OAR at the project site if any of the following results are obtained:

1. Total Petroleum Hydrocarbons are present at concentrations exceeding 100 milligrams per kilogram (mg/kg) for gasoline and 1,000 mg/kg for oil/diesel and long chain hydrocarbons.

2. Solvents and other volatile organic compounds are present at concentrations exceeding the laboratory reporting limit.

3. Polychlorinated biphenyls are present at concentrations exceeding the laboratory reporting limit.

4. Semi-volatile compounds are present at concentrations exceeding the laboratory reporting limit.

5. Organochlorine pesticides are present at concentrations exceeding the laboratory reporting limit.

6. Organophosphorous pesticides are present at concentrations exceeding the laboratory reporting limit.

7. Chlorinated herbicides are present at concentrations exceeding the laboratory reporting limit.

8. California Code of Regulations Title 22 (CAM 17) Metals at concentrations exceeding site-specific background.

9. Hexavalent chromium is present at concentrations exceeding 15 mg/kg.

H. In addition to screening for hazardous materials, the imported soil must be tested and certified to be free of:

1. Organics and debris;

2. Infestation by vermin or insects, in particular fire ants;

3. Boron.

I. Imported materials must be suitable for engineered fill, even if used at landscaping, free from large rocks.

J. Imported materials shall not have a high clay content and must meet the permeability requirements of the projects hardscape if there is such requirement.

K. Evaluate concentrations of metals in import fill by conducting the analysis set forth below.

1. Compare the maximum detected metal concentrations in import fill samples to the Threshold Criteria listed in Table 4. If any metal concentration exceeds its listed background value, the fill material fails and shall be deemed defective and unacceptable for use at the project site unless supported by a site specific health risk assessment.

2. In addition to section 3.01.G.1, import fill shall be deemed environmentally defective and unacceptable for use if any of the following results are obtained:

a. Arsenic concentrations exceed 12.0 mg/kg.

b. Lead concentration exceeds 255 mg/kg or fails TTLC/STLC.

c. Import materials at new project sites with total chromium concentrations greater than or equal to 100 mg/kg shall be tested for hexavalent chromium.

L. All import fill material shall be characterized, handled, and documented in accordance with applicable US EPA and State of California hazardous waste and hazardous materials regulations (See Table 2). For the purpose of this specification, “contaminated” shall mean any soil or geotechnical material at a concentration, which would require disposal at a regulated facility (i.e., California hazardous or RCRA hazardous). OAR must be notified at least 72 hours prior to the disposal of any hazardous waste or hazardous material. No material disposal or reuse can take place without prior written approval of the OAR.

M. Specification test results and OAR approvals shall be valid for a period of 120 days from the date of the subject testing unless a variance is requested by CONTRACTOR and approved by OAR. Previously approved materials shall not be utilized or disposed offsite after the 120 day limit without prior review and approval by the OAR.

N. Requests for variances to this Specification shall be submitted in writing to the OAR a minimum of two weeks in advance of need for review and approval. The request for variance must provide all available testing data, a rationale to support the request and have an active funding line (provided by OAR) to facilitate review by the OAR. OAR will review the request for variance and will provide its preliminary determination within two weeks. Certain requests may require final approval by the Department of Toxic Substances Control (DTSC).

O. Soils with concentrations above Section 01440 screening levels may, upon prior approval by the OAR, may be reused at other project sites if supported by a site-specific human health risk assessment.

P. Details of the samples and testing must be submitted to and approved by the OAR's Environmental Compliance Manager before transportation.

Q. Haul Routes and Regulations/Restrictions: CONTRACTOR must comply with requirements of project EIR (CEQA) and authorities having jurisdiction over the project area and the proposed activities (e.g. Regional Water Quality Control Board, Department of Toxic Substances Control, etc.).

3.03 TRANSPORTATION

A. CONTRACTOR shall pay all fees required by authorities having jurisdiction over area.

B. Contractor shall pay all fees for disposal and/or processing of contaminated and/or hazardous fill materials at a regulated facility.

C. CONTRACTOR shall post and pay for all bonds required by authorities having jurisdiction over area.

TABLE 1: MINIMUM SAMPLING FREQUENCY

Volume (Cubic Yards)	Sampling Frequency
0 – 1,000	1 per 250 CY
1,001 - 5,000	4 samples per first 1,000 CY and 1 sample per each additional 500 CY
Greater then 5,000	12 samples for first 5000 CY and 1 sample per each additional 1,000 CY

Chemicals of Potential Concern	TABLE 2 WASTE CHARACTERIZATION				
	Hazardous Waste if Exceed Criteria - TTLC Level* (mg/kg)	Additional WET Leaching Tests if Exceed Hazardous Waste Criteria - 10 times STLC Level** (mg/kg)	California-Regulated Hazardous Waste - Soluble Threshold Limit Concentration -STLC Level (mg/l)	Additional TCLP Leaching Tests if Exceed Hazardous Waste Criteria - 20 times TCLP Level** (mg/kg)	Federally-Regulated (RCRA) Hazardous Waste - Toxicity Characteristic Leaching Procedure - TCLP Level (mg/l)
CAM 17 Metals					
Antimony	500	150	15	NA	NA
Arsenic	500	50	5	100	5
Barium	10,000	1,000	100	2,000	100
Beryllium	75	7.5	0.75	NA	NA
Cadmium	100	10	1	20	1
Chromium	2,500	50	5	100	5
Cobalt	8,000	800	80	NA	NA
Copper	2,500	250	25	NA	NA
Lead	1,000	50	5	100	5
Mercury	20	2	0.2	4	0.2
Molybdenum	3,500	3,500	350	NA	NA
Nickel	2,000	200	20	NA	NA
Selenium	100	10	1	20	1
Silver	500	50	5	100	5
Thallium	700	70	7	NA	NA
Vanadium	2,400	240	24	NA	NA
Zinc	5,000	2,500	250	NA	NA
Chromium (VI)	500	50	5	NA	NA

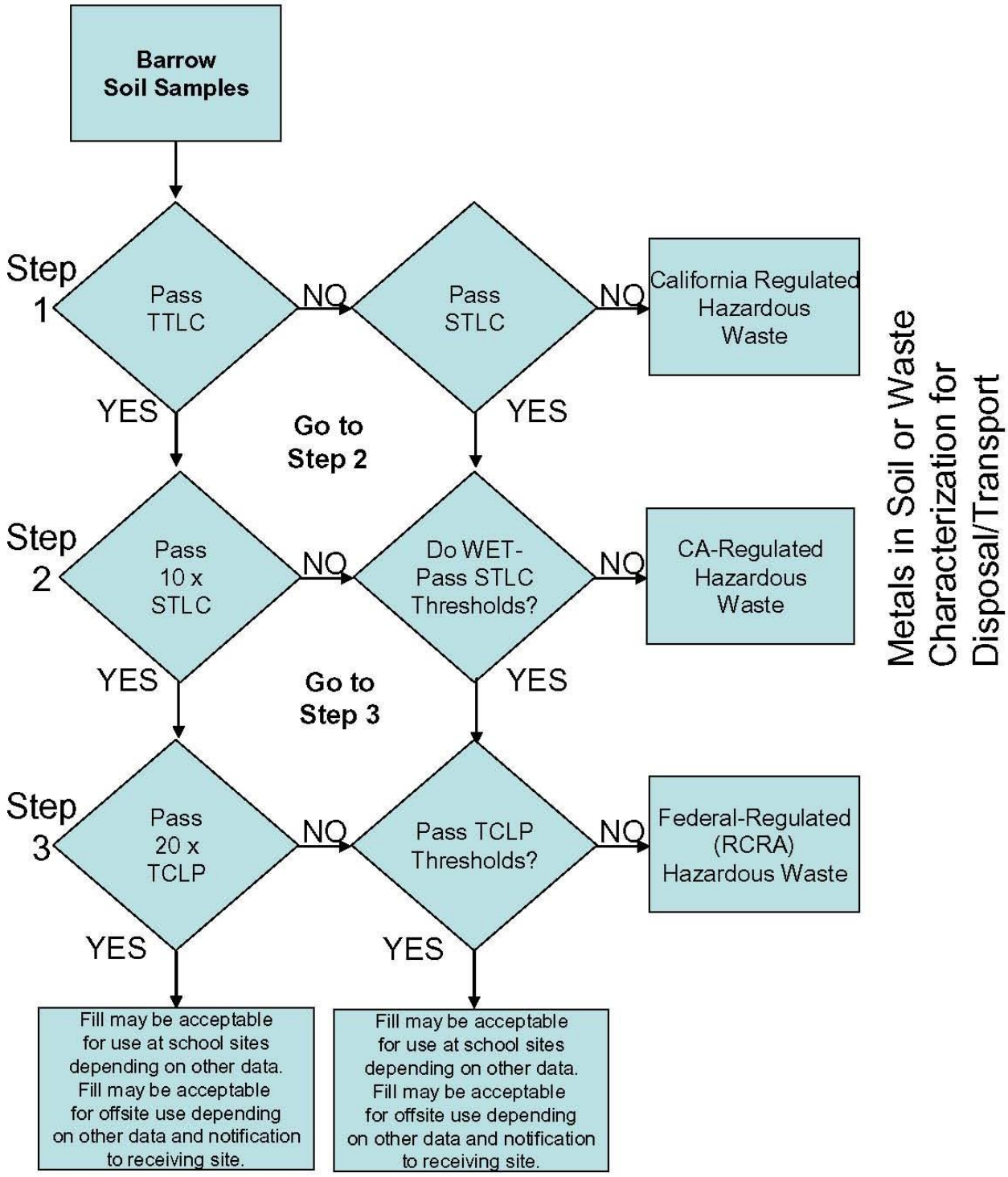
Barrow
Soil Samples
Step 1
Pass TTLC
NO
Pass STLC
NO
California Regulated Hazardous Waste
YES
Go to Step 2
YES
Step 2
Pass 10 x STLC
NO
Do WET-Pass STLC Thresholds?
NO
CA-Regulated Hazardous Waste
YES
Go to Step 3
YES
Step 3
Pass 20 x TCLP
NO
Pass TCLP Thresholds?
NO
Federal-Regulated (RCRA) Hazardous Waste
YES
YES
Fill may be acceptable for use at school sites depending on other data. Fill may be acceptable for offsite use depending on other data and notification to receiving site.
Fill may be acceptable for use at school sites depending on other data. Fill may be acceptable for offsite use depending on other data and notification to receiving site.
Metals in Soil or Waste Characterization for Disposal/Transport

TABLE 4: THRESHOLD CRITERIA FOR METALS IN SOIL - LOOK UP VALUES

CAM 17 Metals	Soil Threshold Criteria (mg/kg)	Basis
Antimony	28	NC
Arsenic	11.3	BK
Barium	2330	NC
Beryllium	16	C
Cadmium	1.4	C
Chromium	106656	NC
Cobalt	4266	NC
Copper	2631	NC
Lead	255	PbB
Mercury	21	NC
Molybdenum	356	NC
Nickel	148	C
Selenium	356	NC
Silver	356	NC
Thallium	4.7	NC
Vanadium	498	NC
Zinc	21331	NC

NC = noncancer health effects

BK = background

C = cancer risk

PbB = blood lead levels

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements governing selection of products for incorporation into the Work.

1.02 RELATED REQUIREMENTS

A. Section 01 3229 - Project Forms.

B. Section 01 3113 - Project Coordination.

C. Section 01 3300 - Submittal Procedures.

D. Section 01 3216 - Construction Schedule.

E. Section 01 4523 - Testing and Inspection.

F. Section 01 2513 - Product Substitution Procedures.

G. Section 01 7836 - Warranties.

1.03 DEFINITIONS

A. Definitions used in this Section are not intended to change the meaning of other terms used in the Contract Documents, such as “specialties,” “systems,” “structure,” “finishes,” “accessories,” and other similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.

1. “Products” are items purchased for incorporation into the Work, whether purchased for the Work or taken from previously purchased stock. The term “product” includes the terms “material” and “equipment” and terms of similar intent.

a. “Named Products,” are items identified by the manufacturer’s product name, including make, model number or other designation, shown or listed in the manufacturer’s published product literature, current as of the date of the Contract.

b. “Foreign Products,” as distinguished from “domestic products,” are items substantially manufactured (50 percent or more of value) outside the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.

2. “Materials,” are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

3. “Equipment,” is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.04 SUBMITTALS

A. Material list: Prepare a list in tabular form acceptable to ARCHITECT and/or OAR showing proposed products. Include generic names. Include the manufacturer's name and proprietary names for each item listed.

1. Coordinate material list with the Construction Schedule and the submittal schedule.

2. Form: Prepare material list with information on each item tabulated under the following column headings.

a. Related Specification Section number.

b. Generic name used in Contract Documents.

c. Proprietary name, model number, and similar designations.

d. Manufacturer's name and address.

e. Supplier's name and address.

f. Installer's name and address.

g. Projected delivery date or time span of delivery period.

3. Initial Submittal: Within ten days after execution of each subcontract agreement, as set forth in General Conditions Article 6.23, submit three copies of an initial material list to the ARCHITECT with a copy to the OAR. Provide a written explanation for omissions of data and for known variations from the Contract Documents.

4. ARCHITECT Action: ARCHITECT will respond in writing to OAR within fourteen days and OAR will forward response to CONTRACTOR within sixteen days of receipt of the completed material list. No response outside this period constitutes no objection to listed items but does not constitute a waiver of the requirement that selected items comply with the Contract Documents. ARCHITECT response will include a list of unacceptable item selections, containing a brief explanation of reasons for this action.

1.05 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1. CONTRACTOR is to verify necessary lead times for all materials; however, when specified products are available only from sources that do not, or cannot, produce a quality adequate to complete Work in a timely manner, consult with the ARCHITECT to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing these qualities, to the fullest extent possible.

B. Compatibility of Options: When the CONTRACTOR is given the option of selecting between two or more products for use in the Work, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion into the Work:

1. No available domestic product complies with the Contract Documents.

2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.

D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products that will be exposed in view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

a. Name of product and manufacturer.

b. Model and serial number.

c. Capacity.

d. Speed.

e. Ratings.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer’s recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Schedule delivery to minimize long-term storage at the Project site and to prevent overcrowding of Work spaces.

2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to the Project site in an undamaged condition in the manufacturer’s original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

5. Store products at the Project site in a manner that will facilitate inspection and measurement of quantity or counting of units.

6. Store heavy materials away from structures in a manner that will not endanger the structure’s supporting construction.

7. Store products subject to damage by the elements above ground, under cover in a weather-tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIAL SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.

1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.

2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other Projects.

B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where Specifications name only a single material or manufacturer, provide the product indicated. No substitutions will be permitted.

2. Semi-proprietary Specification Requirements: Where Specifications name two or more products or manufacturers, provide one of the products indicated. No substitutions will be permitted.

a. Where Specifications specify products or manufacturers by name, accompanied by the term "or equal" comply with General Conditions Article 6.14 to obtain approval for use of an unnamed product.

3. Descriptive Specification Requirements: Where Specifications describe a product or assembly, list exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with the Contract Documents.

4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.

a. Manufacturer's recommendations may be contained in published material literature or by the manufacturer's certification of performance.

5. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes, or regulations specified.

6. Visual Matching: Where Specifications require matching an established Sample, decision of the ARCHITECT will be final on whether a proposed product matches satisfactorily.

7. Visual Selection: Where specified product requirements include the phrase "… as selected from manufacturer's standard or premium colors, patterns, textures…" or a similar phrase, select a product and manufacturer that complies with other specified requirements. The ARCHITECT will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located, and aligned with other Work.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until Substantial Completion.

END OF SECTION

SECTION 01 71 23

FIELD ENGINEERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surveying requirements for the Work.

1.02 RELATED SECTIONS

A. Section 31 2200: Grading

B. Section 32 1216: Asphalt Paving

1.03 SURVEY SERVICE

A. Unless otherwise stated by the Architect or noted in the Special Provisions, the CONTRACTOR shall provide all surveying services.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 SUBMITTALS

A. CONTRACTOR shall submit the name and address of the State of California licensed surveyor to Construction Management Representative (CMR), ARCHITECT and OWNER including any changes as they may occur.

B. CONTRACTOR shall submit to OWNER copies of cut sheets, coordinate plots, data collector printouts, and other documentation as available to verify completeness and/or accuracy of field surveying work.

C. Statement of Compliance: CONTRACTOR shall submit a statement of certification signed and sealed by Surveyor, counter-signed by CONTRACTOR indicating compliance with grade elevations, slopes and tolerances.

3.02 LAYOUT OF THE WORK

A. CONTRACTOR shall employ a State of California licensed surveyor to lay out the entire Work, set grades, lines, levels, control points, vertical and horizontal control, elevations, grids and positions. Before the commencement of Work, surveyor shall, in conjunction with OWNER and Construction Management Representative (CMR) provided engineering survey of the Project site, locate all reference points and benchmarks, then lay out all lines, elevations, and measurements for the entire Work including but not limited to, buildings, grading, paving and utilities.

B. All work under this contract shall be built in accordance with the lines and grades shown on the plans. Field survey for establishing these, and for the control of construction, shall be the responsibility of the Contractor. All such survey work including construction staking shall be done under the supervision of a California Licensed Land Surveyor or authorized Civil Engineer. Staking shall be done on all items ordinarily requiring grade and alignment, at intervals normally accepted by the agencies and trade involved.

C. The CONTRACTOR shall be responsible for any errors in the finished work, and shall notify the Engineer, in writing, within 24 hours, of any discrepancies, or design errors during the construction staking.

D. Contractor shall immediately remediate any areas found not to meet specification requirements.

3.03 PERMANENT SURVEY MARKERS

A. Prior to the start of construction, the Contractor's licensed Land Surveyor or qualified Civil Engineer shall, in conformance with Section 8771 of the California State Business and Professions Code, locate all monuments (both of record and not of record), bench marks, and centerline ties within the construction zone, i.e., within one hundred feet of the construction activity.

B. After construction and prior to final acceptance by the Owner of the construction project, the Contractor's land surveyor or qualified Civil Engineer shall re-survey all field monuments and centerline ties within the construction zone.

C. All survey monuments removed or altered as a result of construction shall be reset, Corner Records filed with the County Surveyor's Office, and approved final Corner Records filed with the City Engineer. Centerline ties removed as a result of construction shall be reset and tie sheets filed with the City Engineer.

D. The Land Surveyor shall provide a letter of certification for all monuments having four or more existing ties which are within 0.02 ft plus or minus of the original City tie sheet records. When several monuments and ties appear on one tie sheet and one of the ties has changed the Land Surveyor shall re-measure all of the ties and re-file a new tie sheet with the City as required herein.

E. County permanent and temporary bench marks within the construction zone shall be located by the surveyor, and the Contractor's Land Surveyor shall send a written notification of impending construction to the County Surveyor's Office two weeks prior to construction.

3.04 SURVEY REQUIREMENTS

A. Establish a minimum of two permanent horizontal and vertical control points on the Project site, remote from the work area, referenced to data established by the survey control points.

B. Indicate the reference points on the project record drawings with the basis of elevation being the established benchmarks.

C. Establish lines, grades, locations and dimensions by instrumentation. From time to time, verify the layout of all Work by the same methods.

D. Provide grade stakes and elevations to construct over excavation and re-compaction, rough and final grades, paved areas, curbs, gutters, sidewalks, building pads, landscaped areas, and other areas as required.

E. Calculate and layout proposed finished elevations and intermediate control as required to provide smooth transitions between the spot elevations indicated in the Contract Documents.

F. Provide stakes and elevations for grading, fill, and topsoil placement.

G. Provide adequate horizontal and vertical control to locate utility lines, including but not limited to, storm, sewers, water mains, gas, electric and signal and provide vertical control in proportion to the slope of the line as required for accurate construction. Dry

utilities will be based upon adequate horizontal and vertical control layout. Prior to trench closure, survey and record invert and flow line elevations. Survey and record top of curb and flow line elevations on finished concrete or AC surfaces at key locations such as BC's, EC's, grade breaks, corners or angle points in sufficient number to demonstrate the Work complies with the intent of the Contract Documents.

H. Provide horizontal and vertical control for batter boards for drainage, utility, and other on-site structures as required.

I. Furnish building corner offsets as required to adequately locate building pads. Provide cut and fill stakes within the building pad perimeter adequate to control both over excavation and re-compaction and the final sub-grade elevation of the building pad.

J. Submit a certification, signed by the surveyor, confirming the elevations and locations of improvements are in conformance with the Contract Documents. The statement shall include survey notes for the finish floor and building pad, showing the actual measured elevations on the completed sub-grade, recorded to the nearest 0.01'. Building pad tolerance will be +- 0.10'.

3.05 ESTABLISHMENT OF GRADES IN PLAY FIELD AREAS

A. Provide Grading Plan and Final survey: Prior to turf installation, a grade verification survey shall be performed. Final grade verification shall consist of site survey conducted by the Owner's surveyor consisting of a 30 ft. x 30 ft. grid. Additional planarity verification shall consist of string line and 10 ft strait edge checks at random over entire area which has been prepared for synthetic turf. Contractor shall immediately remediate any areas found not to meet specification.

B. The permeable base contours of the field, after final compaction and grading, shall not have deviations in surface shape greater than 3/16" over a 10' span. Final contour shall be plotted on a table of laser-sighted grade elevations using a rectangular grid size of 120 yards by 60 yards with measurements every 20 yards (28 total elevation points). Grade elevations to be reviewed and approved prior to installation of the soil isolation fabric. Fine grade to the required tolerances leaving behind no tire tracks or indentations.

C. Contractor shall not proceed with work without Architect's approval.

3.06 ESTABLISHMENT OF GRADES IN HARDSCAPE AREAS

A. All work shall conform to the lines, elevations, and grades shown on the Grading Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

B. Areas having drainage gradients of 2 percent or more shall have elevation stakes, set with instrument, at grid intervals of 25 feet. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes. Grade stakes must be set at all grade breaks, grade changes, etc.

C. Areas having drainage gradients of less than 2 percent shall have elevation stakes, set with instrument, at 10 foot intervals. Grade stakes must be set at all grade breaks, grade changes, etc.

D. Protect and maintain stakes in place until their removal is approved by the Owner. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.

3.07 STORM DRAIN PIPE INSTALLATION

A. All storm drain pipelines, catch basins and drain inlets shall be staked by a licensed surveyor if slope of grade is less than 2% and a complete set of cut sheets shall be supplied to the Inspector. All construction staking shall be installed and verified for grade and alignment prior to the start of construction.

3.08 RECORD DRAWINGS

A. Upon Substantial Completion, CONTRACTOR shall obtain and pay for reproducible transparencies (or electronic files) of the as built survey drawings. Deliver to ARCHITECT, final “record” drawings of the original drawings and completed Work within specified tolerances.

B. Record drawings shall indicate locations by coordinate of all utilities onsite with top of pipe elevations at major grade and alignment changes, rim grate or top-of-curb and flow line elevations of all drainage structures and manholes.

C. Completed record drawing transparencies (or electronic files) shall be signed and certified as correct and within specified tolerances by the licensed surveyor.

D. Attention is called to other sections of the Contract Documents requiring verification or measurements of installed Work by survey. Surveyor shall perform and certify all such surveys or verification are completed in accordance with the Contract Documents.

END OF SECTION

SECTION 01 7329

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies procedural requirements for cutting and patching.

1.02 RELATED REQUIREMENTS

A. Section 01 2973 - Schedule of Values.

B. Section 01 3113 - Project Coordination.

C. Section 01 3119 - Project Meetings.

D. Section 01 3216 - Construction Schedule.

E. Section 01 3300 - Submittal Procedures.

F. Section 01 7123 - Field Engineering.

G. Section 01 7836 - Warranties.

1.03 SUBMITTALS

A. The word “cutting” as used in the Contract Documents includes, but is not limited to, cutting, drilling, chopping, and other similar operations and the word “patching” includes, but is not limited to, patching, rebuilding, reinforcing, repairing, refurbishing, restoring, replacing, or other similar operations.

B. Cutting and Patching Proposal: CONTRACTOR shall submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Contract Documents requires approval of these procedures before proceeding. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required. Denote how it will be performed and indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building’s appearance or other significant visual elements.

3. List products to be used and firms or entities that will perform this Work.

4. Indicate dates when cutting and patching will be performed.

5. Utilities: List utilities that cutting and patching operations will disturb or affect. List utilities to be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.

7. Review by ARCHITECT and DSA prior to proceeding with cutting and patching does not waive ARCHITECT right to later require complete removal and replacement of defective Work.

1.04 QUALITY ASSURANCE

A. Requirements for structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval from ARCHITECT and DSA of the cutting and patching proposal before cutting and patching the following structural elements:

a. Foundation construction.

b. Bearing and retaining walls.

c. Structural concrete.

d. Structural steel.

e. Lintels.

f. Timber and primary wood framing.

g. Structural decking.

h. Miscellaneous structural metals.

i. Equipment supports.

j. Piping, ductwork, vessels, and equipment.

m. Structural systems of special construction in Division 13 Sections.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safely.

1. Obtain review of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

a. Primary operational systems and equipment.

b. Air or smoke barriers.

c. Water, moisture, or vapor barriers.

d. Membranes and flashings.

e. Fire protection systems.

f. Noise and vibration control elements and systems.

g. Control systems.

h. Communication and/or data systems.

i. Conveying systems.

j. Electrical wiring systems.

k. Operating systems of special construction in Division 13 Sections.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the opinion of ARCHITECT, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

1. If possible, retain the original installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original installer or fabricator, engage another recognized experienced and specialized firm.

a. Firestopping.

b. Acoustical ceilings.

c. Acoustical panels.

d. Finished wood flooring.

e. Carpeting.

f. HVAC enclosures, cabinets, or covers.

g. Ceramic and quarry tile.

h. Gypsum board.

i. Masonry (exterior and interior where exposed).

j. Tack boards.

k. Casework.

l. Finish carpentry.

1.05 WARRANTY

A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

1. Before proceeding, meet at the Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

A. Temporary support: Provide adequate temporary support of existing improvements or Work to be cut.

B. Protection: Protect existing improvements and Work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of existing improvements or Work 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. Where the Work requires sandblasting of existing surfaces in order to receive new materials secured by cementitious, adhesive or chemical bond, completely remove existing finishes, stains, oil, grease, bitumen, mastic and adhesives or other substances deleterious to the new bonding or fastening of new Work. Utilize wet sand blasting for interior surfaces and for exterior surfaces where necessary to prevent objectionable production of dust.

3.03 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay. Carefully remove existing Work to be salvaged and/or reinstalled. Protect and store for reuse into the Work. Verify compatibility and suitability of existing substrates before starting the Work.

B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining Work. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or a diamond-core drill. Saw cut reinforcing bars and paint ends with bituminous paint except where bonded into new concrete or masonry.

4. Comply with requirements of applicable Sections of Divisions 31, 32, and 33 where cutting and patching requires excavating, backfill, and recompaction.

5. Woodwork: Cut and or remove to a panel or joint line.

6. Sheet Metal: Remove back to joint, lap, or connection. Secure loose or unfastened ends or edges and seal watertight.

7. Glass: Remove cracked, broken, or damaged glass and clean rebates and stops of setting materials.

8. Plaster: Cut back to sound plaster on straight lines, and back bevel edges of remaining plaster. Trim existing lath and prepare for new lath.

9. Gypsum Wallboard: Cut back on straight lines to undamaged surfaces with at least two opposite cut edges centered on supports.

10. Acoustical ceilings: Remove hanger wires and related appurtenances where ceilings are not scheduled to be installed.

11. Tile: Cut back to sound tile and backing on joint lines.

12. Flooring: Completely remove flooring and clean backing of prior adhesive. Carefully remove wood flooring for patching and repairing of existing wood flooring scheduled to remain.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with required tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation. Verify conditions of existing substrates prior to executing Work.

2. Restore exposed finishes of patched areas and extend finish restoration into retaining adjoining construction in a manner that will eliminate all evidence of patching and refinishing.

3. Concrete: Maintain cut edges in a moist condition for twenty four hours prior to the placement of new concrete. In lieu of this an epoxy adhesive may be provided. Finish placed concrete to match existing unless noted otherwise. Concrete shall have a compressive strength of 3,000 psi where installed to repair and match existing improvements, unless noted otherwise.

4. Metal Fabrications: Items to remain exposed shall have their edges cut and ground smooth and rounded.

5. Sheet Metal: Replace removed or damaged sheet metal items for new Work.

6. Glass: Install matching glass and re-seal exterior window assemblies.

7. Lath and Plaster: Install new lath materials to match existing and fasten to supports at 6-inch centers. Provide a 6-inch lap where new lath to adjoins

existing lath. Fasten new lath as required for new Work. Restore paper backings as required. Apply a bonding agent on cut edges of existing plaster. Apply three coat plaster of the type, thickness, finish, texture, and color to match existing.

8. Gypsum Wallboard: Fasten cut edges of wallboard. Install patches with at least two opposite edges centered on supports and secure at 6-inch centers. Tape and finish joints and fastener heads. Patching shall be non-apparent when painted or finished.

9. Acoustical Ceilings: Comply with the requirements for new Work specified in related sections of the Contract Documents.

10. Resilient Flooring: Completely remove flooring and prepare substrate for new material.

11. Painting: Prepare areas to be patched, patch and paint as specified under related sections of the Contract Documents.

3.04 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged coverings to their original condition.

END OF SECTION

SECTION 01 7700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for Contract Closeout, including but not limited to, the following:

1. Inspection procedures.

2. Project record documents submittal.

3. Operation and maintenance manual submittal.

4. OWNER orientation and instruction.

5. Final cleaning.

1.02 RELATED REQUIREMENTS:

1. Section 01 2976 - Progress Payment Procedures.

2. Section 01 3216 - Construction Schedule.

3. Section 01 3229 - Project Forms.

4. Section 01 3300 - Submittal Procedures.

5. Section 01 7836 - Warranties.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 SUBSTANTIAL COMPLETION

A. Inspection Procedures: On receipt of the Request For Certificate of Substantial Completion, OAR will authorize commencement of inspection. INSPECTOR, OAR, CONTRACTOR and ARCHITECT will inspect the Work.

1. If after inspection of the Work, OAR does not consider the Work substantially complete, OAR will notify CONTRACTOR.

2. If after inspection, OAR considers the Work substantially complete, INSPECTOR shall prepare a comprehensive Punch List of items to be corrected.

a. INSPECTOR may repeat inspection to assure the Work is corrected.

b. Results of the completed inspection will form a partial basis of the requirements for Release of Retention.

3.02 ADMINISTRATIVE CLOSEOUT

A. Re-inspection Procedures: INSPECTOR, OAR, CONTRACTOR and ARCHITECT may inspect the Work upon notice, including final inspection of Punch List items from earlier inspections, has been corrected, except for items whose completion is delayed under circumstances acceptable to OAR.

1. OWNER has the right to preclude CONTRACTOR from Punch List correction and documents submittals after the Contract Completion date; unless OWNER elects to authorize CONTRACTOR to extend Administrative Contract duration. CONTRACTOR will be assessed actual cost for the unsettled items. Withholds amounts exceeding actual costs to correct or to obtain deliverable will be released.

2. If allowed by the OAR, re-inspection will be repeated, but may be assessed against CONTRACTOR if OWNER is subject to additional professional service and or additional costs of inspection.

3.03 PROJECT RECORD DOCUMENT SUBMITTAL

A. General: Do not use project record documents for construction purposes. Protect record documents from deterioration and loss. Provide access to record documents for ARCHITECT, INSPECTOR and OAR reference during normal working hours. Project record document shall be updated on a weekly basis. Prior to submitting each application for payment, secure INSPECTOR and ARCHITECT approval of project record documents.

B. Record Drawings: Maintain a clean, undamaged set of prints of Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark the Drawing that is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Drawings. Provide detailed and accurate field dimensions for concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work. Date and number entries in the same format as submitted. Call attention to entry by a “cloud” around the affected areas.

2. Mark new information important to OWNER but was not shown on Drawings or Shop Drawings.

3. Utility location and depth below finished grade and above ceilings and attic spaces shall be fully dimensioned and indicated on record drawings. Dimensions shall be measured from building lines or permanent landmarks and shall be triangulated to those features.

4. Note related Change Order or Construction Directive numbers where applicable. RFC submissions shall be referenced on each affected sheet, Drawing and Shop Drawing.

5. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

6. Prior to Contract Completion of the Work, review of the project record drawings by ARCHITECT; prepare a final set of project record drawings using reproducible vellum. Submit final set of transparencies to ARCHITECT.

C. Record Specifications: Maintain two complete copies of the Specifications, including Addenda. Include with the Specifications two copies of other written Contract Documents, such as Change Orders or Construction Directives issued during construction.

1. Mark these record documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

2. Give particular attention to substitutions and selection of options and information on concealed Work that cannot otherwise be readily discerned later by direct observation.

3. Note related record document information with Product Data.

4. Prior to Contract Completion of the Work, submit record Specifications to ARCHITECT for OWNER records.

D. Record Product Data: Maintain two copies of each Product Data submittal. Note related Change Orders and Construction Directives and mark-up of record drawings and Specifications.

1. Mark these documents to illustrate significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the Project site and from the manufacturer's installation instructions and recommendations.

2. Provide detailed and accurate information regarding concealed products and portions of Work that cannot otherwise be readily discerned later by direct observation.

3. Prior to Contract Completion, submit complete set of record Product Data to ARCHITECT for OWNER records.

E. Record Samples: Immediately prior to Substantial Completion, CONTRACTOR shall meet with ARCHITECT and OAR at the Project site to determine which Samples are to be transmitted to OWNER for record purposes. Comply with OAR instructions regarding delivery to OWNER storage area.

F. Miscellaneous Records: Refer to other Specification sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Prior to the date of Contract Completion, complete and compile miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to Architect for OWNER records.

G. Maintenance Manuals: Prior to Substantial Completion, organize operation and maintenance data into suitable two sets of manageable size. Bind properly indexed data in individual, heavy-duty, two to three-inch 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of

each binder. Submit to ARCHITECT for OWNER records. Include the following types of information.

1. Emergency instructions.

2. Spare parts list.

3. Copies of warranties.

4. Wiring diagrams.

5. Recommended “turn-around” cycles.

6. Inspection procedures.

7. Shop Drawings and Product Data.

8. Fixture lamping schedule.

H. Verified Reports: Construction progress of the Work shall be reported to DSA via a duly verified report as per Title 24, Part 1, Sections 4-336 and 4-343.c of the California Building Standards Commission’s, California Administrative Code.

3.04 OPERATION AND MAINTENANCE:

A. Operation and Maintenance Instructions: Prior to Substantial Completion, arrange for each installer of equipment that requires regular operation and maintenance to meet with designated OWNER personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer’s representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals.

2. Spare parts and materials.

3. Tools.

4. Lubricants.

5. Fuels.

6. Identification systems.

7. Control sequences.

8. Hazards.

9. Cleaning.

10. Warranties and bonds.

11. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.

2. Shutdown.

3. Emergency operations.

4. Noise and vibration adjustments.

5. Safety procedures.

6. Economy and efficiency adjustments.

7. Effective energy utilization.

C. Notice Of Termination: CONTRACTOR shall submit a Notice of Termination (NOT) to the local Regional Water Quality Control Board, RWQCB. Provide a copy of NOT to OAR.

3.05 FINAL CLEANING

A. General: Related sections of the Contract Documents specify general cleaning during performance of the Work. General cleaning is included in Division 01 Section “Construction Facilities and Temporary Controls”.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer’s instructions.

1. Complete the following cleaning operations before requesting inspection for a certificate of Substantial Completion.

a. Remove labels that are not permanent labels.

b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

e. Clean the Project site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

END OF SECTION

SECTION 01 7836

WARRANTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for warranties, including manufacturers and installer's standard warranties on products and special product warranties.

1. Refer to the General Conditions for terms of the guarantee period for the Work.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements.

B. Section 01 7329 - Cutting and Patching.

C. Section 01 7700 - Contract Closeout.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 WARRANTY REQUIREMENTS

A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties shall not relieve CONTACTOR of the warranty of the Work incorporating such materials, products, and equipment. Manufacturer's disclaimers and limitations on warranties do not relieve suppliers, manufacturers, installers, and Subcontractors of the requirement to countersign special warranties with CONTRACTOR.

B. Standard warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to OWNER.

C. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for OWNER.

D. Related Damages and Losses: When correcting failed or defective warranted Work, remove and replace Work that has been damaged as a result of such failure or which must be removed and replaced to provide access for correction of warranted Work.

E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement with the reinstated warranty equal to the original warranty.

F. Replacement Cost: Upon determination the Work covered by a warranty has failed and/or is defective, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. CONTRACTOR is responsible for the cost of replacing or rebuilding defective Work regardless of whether OWNER has benefited from use of the Work through a portion of its anticipated useful service life.

G. OWNER Recourse: Expressed warranties made to OWNER are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which OWNER can enforce such other duties, obligations, rights, or remedies.

H. Rejection of Warranties: OAR reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

I. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, OAR reserves the right to refuse to accept the Work until CONTRACTOR presents evidence the entities required to countersign such commitments have done so.

3.02 SUBMITTALS

A. Submit written preliminary warranties prior to Substantial Completion and final warranties prior to Contract Completion. If the certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, submit written warranties as set forth in the certificate of Substantial Completion.

1. When a designated portion of the Work is partially used and/or occupied by OWNER, submit properly executed warranties to ARCHITECT within fifteen days of the Partial Use or Occupancy of the designated portion of the Work.

B. When the Contract Documents require CONTRACTOR, or CONTRACTOR and a Subcontractor, installer, supplier or manufacturer to execute a special warranty, prepare a written document containing appropriate terms and identification, ready for execution by the required parties. Submit a draft to OAR, through the ARCHITECT, for approval prior to final execution.

1. Refer to Divisions 02 through 49 for specific content requirements and particular requirements for submitting special warranties.

C. Form of Submittal: Prior to Contract Completion, compile two copies of each required final warranty properly executed by CONTRACTOR, or by CONTRACTOR and Subcontractor, installer, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the Specifications.

D. Bind warranties and bonds in heavy-duty, commercial-quality, durable three ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½ by 11 paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the item or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the installer.

2. Identify each binder on the front and spine with the typed or printed title “WARRANTIES,” Project title and/or name, and name of CONTRACTOR.

3. When warranted Work requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF SECTION

SECTION 02 4116

DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes: Furnishing all labor, materials and equipment necessary for demolition, dismantling, cutting and alterations as indicated, specified, and required for completion of the Contract, as applicable. Includes items such as the following:

1. Protecting existing work to remain.

2. Cleaning soiled materials that are to remain.

3. Disconnecting and capping utilities.

4. Removing debris and equipment.

5. Removal of items indicated on Drawings.

6. Salvageable items to be retained by the Owner as indicated on the Drawings and during the pre-construction job walk.

C. Related Sections:

1. Section 31 2200: Grading.

2. Section 31 1000: Site Clearing.

1.02 QUALITY ASSURANCE

A. Comply with the following:

1. Applicable codes, ordinances, regulations of local, municipal, state and federal authorities having jurisdiction.

2. Obtain necessary permits and notices, post where required.

3. Comply with safety requirements of the local fire department.

4. Comply with ANSI A10.6.

5. Comply with Standard Specification for Public Works Construction (Green Book)

B. Demolition Firm Qualifications: Engage an experienced, licensed firm having a minimum of (5) years full time satisfactory experience in demolition work of similar scope and complexity to that indicated for this Project.

C. Notify affected utility companies before starting Work and comply with their requirements.

D. Carefully perform demolition work, by skilled workers experienced in building demolition procedures, using appropriate tools and equipment. Perform work, at all times, under the direct supervision of a supervisor approved by the Owner Inspector.

E. Coordinate demolition with other trades to ensure correct sequence, limits, and methods of proposed demolition. Schedule work to create least possible inconvenience to the public and to facility operations.

F. Pre-Demolition: Conduct conference at Project site 7 days prior to scheduled installation.

1. Conference agenda shall include review and discussion of requirements of authorities having jurisdiction, instructions and requirements of serving utilities, sequencing and interface considerations and Project conditions.

2. Conference shall be attended by supervisory and quality control personnel of Contractor and all subcontractors performing this and directly related work. Submit minutes of meeting to Owner's Representative for Project record purposes.

1.03 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to location as directed by Owner's Representative.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Owner's Representative, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.

E. Replace: Remove and legally dispose of existing item(s) indicated and install new like item(s) that conform to project specifications.

1.04 OWNERSHIP OF MATERIALS

A. Ownership of Materials: Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.05 PROJECT CONDITIONS

A. Drawings may not indicate in detail all demolition work to be carried out. Carefully examine existing conditions to determine full extent of demolition required. All utilities, whether shown on the drawings or not, to be capped at the property line U.N.O.

B. Repair damage due to demolition activities to existing improvements to remain at no additional cost to the Owner. Repair or replace as directed by the Owner Inspector.

C. Take measures to avoid excessive damage from inadequate or improper means and methods, or improper shoring, bracing or support. Repair or replace any resulting damage at no additional cost to the owner as directed by the Owner Inspector.

D. If conditions are encountered that vary from those indicated, notify the Owner Inspector for instructions prior to proceeding. Owner assumes no responsibility for actual condition of structures to be demolished.

E. Inform Owner immediately upon discovery of asbestos products, radioactive materials, toxic wastes or other hazardous materials. Do not remove hazardous materials without Owner authorization.

F. Adjacent roadways/passageways:

1. Maintain fire department access through all phases of the project.

2. Obstruction of streets, walks or other adjacent facilities will not be allowed.

1.06 DIG ALERT NOTIFICATION

A. Before any excavation in or near the public right-of-way, the Contractor must contact the Underground Service Alert of Southern California (Dig Alert) at **811** for information on buried utilities and pipelines.

B. Delineation of the proposed excavation site is mandatory. Mark the area to be excavated with water soluble or chalk based white paint on paved surfaces or with other suitable markings such as flags or stakes on unpaved areas.

C. Call at least Two (2) full working days prior to digging.

D. If the members (utility companies) have facilities within the work area, they will mark them prior to the start of your excavation and if not, they will let you know there is no conflict. A different color is used for each utility type (electricity is marked in red, gas in yellow, water in blue, sewer in green, telephone and cable TV in orange).

E. The Law requires you to hand expose to the point of no conflict 24" (inches) on either side of the underground facility, so you know its exact location before using power equipment.

F. If caught digging without a Dig Alert ticket you can be fined as much as $50,000 per California government code 4216.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: In general, the on-site earth materials should be suitable for reuse as fill, provided that environmentally impacted soils found during Ninyo & Moore's preliminary endangered assessment, if any, are first excavated and removed from the site. Fill material should also be free of trash, debris, roots, vegetation, or other deleterious materials. Fill should generally be free of rocks or lumps of material in excess of 4 inches in diameter. Rocks or hard lumps larger than approximately 4 inches in diameter should be broken into smaller pieces or should be removed from the site. Fill used as structural backfill, should be comprised of granular, non-expansive soil that conforms to the latest edition of "Greenbook" Standard Specifications for Public Works Construction (Greenbook) for structural backfill. "Non-expansive" is defined as soil having an EI of 20 or less in accordance with ASTM International (ASTM) D 4829 (CBC, 2013).

B. Import Fill Material: Imported materials should consist of clean, non-expansive granular material which conforms to the 2015 edition of Greenbook. The imported materials should meet the Caltrans (2012) criteria for non-corrosive soils (i.e., soils having a chloride concentration of 500 parts per million [ppm] or less, a soluble sulfate content of approximately 0.20 percent [2,000 ppm] or less, a pH value of 5.5 or higher and a minimum resistivity of 1,000 ohm-centimeters [ohm-cm] or higher). Materials for use as fill should be evaluated by the geotechnical consultant prior to importing. The contractor should be responsible for the uniformity of import material brought to the site.

C. Engineered Fill: Satisfactory Soil Materials / Borrow Fill Material, as described above, placed in lifts no greater than 8 inches thick (loose measurements), and compacted to a minimum of 90% of the soil's maximum dry unit weight.

D. Backfill Material for Trenches:

1. The on-site soils may be used for backfilling utility trenches from one foot above the top of pipe to the surface, provided the material is free of organic matter and deleterious substances. Any soft and/or loose materials or fill encountered at pipe invert should be removed and replaced with properly compacted fill or adequate bedding material. Also, rocks larger than 4 inches and boulders should not be used as backfill.

2.02 HANDLING OF MATERIALS

A. Items scheduled for salvage by the Owner shall be delivered to a location designated by the Owner's Authorized Representative. Items shall be cleaned, packaged and labeled for storage.

B. Items scheduled for reuse shall be stored on site and protected from damage, soiling and theft.

PART 3 - EXECUTION

3.01 GENERAL

A. Protection:

1. Do not begin demolition until safety partitions, barricades, warning signs and other forms of protection are installed.

2. Provide safeguards, including warning signs, lights and barricades, for protection of occupants and the general public during demolition.

3. Provide and maintain fire extinguishers. Comply with requirements of governing authorities.

4. Maintain existing utilities which are to remain in service and protect from damage during operations.

B. Safety: If at any time safety of existing construction appears to be endangered, take immediate measures to correct such conditions; cease operations and immediately notify the Owner Inspector. Do not resume demolition until directed by the Owner Inspector.

C. Noise and Dust Abatement: Exercise all reasonable and necessary means to abate dust, dirt rising and undue noise. Perform necessary sprinkling and wetting of construction site to allay dust as required by applicable codes and ordinances

D. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations. Do not create hazardous or objectionable conditions, such as flooding and pollution, when using water.

E. Water for Dust Control: Contractor shall obtain and pay for all water required for his dust control operations. This may include, but is not limited to, payment of deposits to utility for construction meter, and payment of all monthly service and water charges. Construction meter shall be in place throughout construction period unless alternative arrangements are made with the Water Department to provide construction water for all purposes. Contractor shall be aware of water moratoriums and restrictions, and shall immediately advise Owner of effects on construction schedules.

F. A 6 foot high, chain link fence and gates, shall be erected prior to any demolition operations at the construction limits perimeter. Coordinate the exact location with Owner. Comply with specification section 32 3113: Chain Link Fencing Gate.

G. Deliver salvaged material to a location designated by the District. Contractor shall be responsible for all such materials, fittings, fixtures, etc., and shall use the utmost care in their removal, so as to insure the least possible damage to the same or surrounding work.

H. Debris Removal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

I. Progress Cleaning: Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

J. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

K. Where performing contracted scope of work requires coring of existing concrete, brick masonry, or CMU structures (including Walls, Floors, and Sitework), contractor shall obtain and document means of verifying existence and location of embedded steel reinforcing materials within said concrete, brick and CMU assemblies. Contractor shall locate reinforcement by means of non-invasive technology such as X-ray photography for the purposes of protecting said reinforcement in place and shall not damage any reinforcement materials (rebar, etc.) unless specifically detailed as such and approved by the authority having jurisidiction.

L. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

M. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

N. Contractor shall provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.

O. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.

P. Cover and protect furniture, furnishings, and equipment that have not been removed.

Q. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.

R. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

S. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials if exposed, repaired surfaces shall match existing adjacent surface color finish and texture.

1. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

T. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance.

U. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

V. Disposal: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

3.02 PREPARATION

A. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary.

B. Utilities:

1. The Drawings do not purport to show all below-grade conditions and objects on the site. Contractor shall perform field investigations as necessary to establish location of underground utility services and other features affecting earthwork.

2. Mark location of underground utilities on asphalt pavement with paint

3. Disconnect and cap utility services; comply with requirement of governing authorities.

4. Contractor shall arrange and notify utility company in advance of date and time when service needs to be disconnected.

5. Do not commence demolition operations until associated disconnections have been completed.

6. Should utilities and other below-grade conditions be encountered which adversely affect the Work, discontinue affected Work and notify Owner's Representative and Architect and request direction. Unforeseen conditions will be resolved in accordance with provisions of the General Conditions of the Contract.

7. Should a utility line or structure be damaged, immediately notify the responsible utility company or agency and notify Owner’s Representative and Architect.

a. Repair or replace all damaged utility lines and structures as directed by the responsible utility company or agency.

b. Repair or replacement of damaged utility lines and structures whole location or existence has been made known to the Contractor shall be at no change in the Contract Time and Contract Price.

C. Structures to be demolished shall be inspected for hazardous materials. Such materials shall be removed and disposed of before general demolition begins.

D. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner's Representative and Authority Having Jurisdiction (AHJ). Provide temporary services during interruptions to existing utilities, as acceptable to Owner's Representative and to Authority Having Jurisdiction (AHJ).

3.03 EXPLOSIVES

A. Explosives: Use of explosives will not be permitted.

3.04 DEMOLITION

A. Demolition, General:

1. With certain exceptions, the Contractor shall raze, remove and dispose of all buildings and foundations, structures, paving, fences and other obstructions that lie wholly or partially within the construction limits identified on Drawings. The exceptions are utility-owned equipment and any other items the Owner/Documents may direct the Contractor to leave intact or re-use onsite. Cease demolition immediately if adjacent structures appear to be in danger.

2. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

3. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner's Representative and Authority Having Jurisdiction (AHJ). Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

4. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.

a. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.

b. Protect existing site improvements, appurtenances, and landscaping to remain.

c. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

5. Structural Stability: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of buildings or portions thereof to be demolished and adjacent buildings to remain. Strengthen or add new supports when required during progress of demolition.

6. Below-Grade Construction: Demolish foundation walls and other below-grade construction, as follows:

a. Remove below-grade construction, including foundation walls and footings, to at least 18-inches below grade, but at least to bottom of footing or foundation wall.

b. Completely remove below-grade construction, including foundation walls and footings.

7. Filling Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition of buildings and pavements with soil materials according to requirements specified in Section 31 2200 - Grading.

8. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

9. Unless otherwise indicated on the plans, remove all demolished material from the site and dispose of at approved disposal sites. Comply with all requirements for recycling of demolished material as called for in Division 1 of this Specification. The contractor shall obtain necessary permits for the transportation of material from the site.

3.05 REMOVAL OF EXISTING PLUMBING AND ELECTRICAL EQUIPMENT AND SERVICES

A. Remove existing plumbing and electrical equipment fixtures and services not indicated for reuse and not necessary for completion of work. Remove abandoned lines and cap unused portions of existing lines. The Contractor is responsible for completely surveying the site and locating all existing utilities, above and below ground, before contracting to perform the work.

B. Asbestos – Cement (A-C) Pipe Removal and Disposal: The plans for the project may indicate that existing asbestos-cement pipe is to be removed from the ground. Where so indicated the Contractor shall excavate with care, expose the pipeline and remove the A-C pipe to the nearest joint. Should the plans not call out the removal of the A-C pipe and A-C pipe is encountered, the Contractor shall obtain approval from the Owner as to whether or not the A-C pipe is to be removed or can be left in place. Cutting of the pipe shall only be done if absolutely there is no other way to expose the length of pipe to the nearest joint that be separated and the Owner approves the cutting of the pipe. Cutting of the pipe shall be done with a mechanical saw with a pressure water source to dampen the pipe and the dust from the cutting. To remove a coupling, the coupling may have to be broken in the trench. The pipe once removed from the trench may be broken for handling. The breaking shall be done within a plastic bagging or sheeting material to minimize the release of asbestos fibers into the atmosphere. Once removed and broken, if necessary, the A-C material shall be bagged and disposed of legally with the Owner to be given a copy of all Contractor paperwork as to the legal disposal of the material. If the A-C pipe section(s) are removed intact the pipe can be removed by the Contractor from the project site and become the property and responsibility of the Contractor.

3.06 CLEANING

A. Clean existing materials to remain, using appropriate tools and materials.

B. Protect adjacent materials and equipment during cleaning operations.

3.07 PATCHING AND RESTORATION

A. Patching: Where removals leave holes and damaged surfaces that will be exposed in the completed construction, such holes and damaged surfaces shall be patched and restored to match adjacent finished surfaces.

1. Where new finish construction is applied over existing holes and damaged surfaces, patching and restoration shall be performed to the extent to make the substrate suitable for the provision of new finish construction.

2. Surfaces of patched and restored areas shall be flush with the adjacent existing surfaces and shall closely match existing adjacent surfaces in texture and finish.

B. Restoration of Site Finishes:

1. Concrete paving: Where it is necessary to excavate a trench across make a cut in concrete paved areas, cut concrete cutting saw, full depth of paving.

2. Bituminous paving: Where it is necessary to excavate a trench across make a cut in bituminous paved areas, either first score paving with a concrete cutting saw, in neat straight lines, prior to removing paving or make straight cuts with pneumatic spade.

3. Restoration of paving: Restore all paved areas to their original condition using material of like type and quality as the removed paving. Paving in public ways shall conform to applicable requirements of authorities having jurisdiction. Repaired surfaces shall match existing adjacent paving except minimum depth shall be 3-1/2 inches where existing paving is less than 3-1/2 inches.

4. Restoration of landscape planting: Restore soil and plant materials to match original condition, including additional topsoil, topsoil grading and preparation, new plant materials and plant maintenance during establishment period.

5. Restoration of existing chain link fencing that remains in place.

3.08 MAINTENANCE

A. Install and maintain all erosion control devices, including sandbag and gravel bag dikes, silt fences, de-silting basins, inlet barricades, vehicle wash traps, and other features called for in the Storm Water Pollution Prevention Plan and Temporary Erosion Control Plans.

3.09 CLEAN-UP/DISPOSAL

A. Coordinate building access with the Owner Inspector. Review and schedule waste storage and removal, include truck access to site.

B. Debris shall be dampened by fog water spray prior to transporting by truck.

C. Debris pick-up area shall be kept broom-clean and shall be washed daily with clean water.

D. Remove waste and debris, other than items to be salvaged. Turn over salvaged items to Owner, or store and protect for reuse where scheduled. Continuously clean-up and remove items as demolition work progresses. Do not allow waste and debris to accumulate in building or on site.

END OF SECTION

SECTION 03 2000

CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete steel reinforcement.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 01 4523: Testing and Inspection.

3. Section 03 1000: Concrete Forming.

4. Section 03 3000: Cast-In-Place Concrete.

1.02 REGULATORY REQUIREMENTS

A. Fabrication and placement of reinforcing shall be in accordance with requirements of CBC, Chapter 19A.

1.03 REFERENCES:

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

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

3. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

5. ASTM A497 - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

6. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

7. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

B. American Concrete Institute (ACI) Publication:

1. ACI SP-66 – ACI Detailing Manual.

2. ACI 318 – Building Code Requirements for Structural Concrete, as modified by CBC Sections 1903A and 1908A.

C. American Welding Society (AWS):

1. AWS D1.4 – Structural Welding Code – Reinforcing Steel.

1.04 SUBMITTALS

A. Shop Drawings: Submit steel reinforcement Shop Drawings in accordance with ACI 315. Include assembly diagrams, bending charts and slab plans. Indicate lengths and location of splices, size and lengths of reinforcing steel.

B. Closeout Submittals: Record exact locations of reinforcing that vary from Shop Drawings.

1.05 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.

2. American Welding Society (AWS).

3. American Concrete Institute (ACI).

4. CBC, Chapter 19A, Concrete.

B. Source Quality Control: Refer to Division 01 Sections for general requirements and to the following paragraphs for specific procedures. Testing laboratory retained by the Owner shall select test Samples of bars, ties, and stirrups from the material at the Project Site or from the place of distribution, with each Sample consisting of not less than two 18 inch long pieces, and perform the following tests according to ASTM A615, or ASTM A706, as applicable:

1. Identified Bars: If Samples are obtained from bundles as delivered from the mill, identified as to heat number, accompanied by mill analyses and mill test reports, and properly tagged with the identification certificate so as to be readily identified, perform one tensile and one bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when Samples are selected.

2. Unidentified Bars: When positive identification of reinforcing bars cannot be performed and when random Samples are obtained; perform tests for each 2.5 tons or fraction thereof, one tensile and one bend test from each size of bars.

C. Certification of Welders: Shop and Project site welding shall be performed by welding operators certified by AWS.

1.06 DELIVERY, STORAGE AND HANDLING

A. Avoid exposure to dirt, moisture or conditions harmful to reinforcing.

B. Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated for size and shape.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide reinforcing of sizes, gages and lengths indicated, bent to indicated shapes.

2.02 MATERIALS

A. Steel Reinforcing Bars: ASTM A615, or ASTM A706 deformed grade 60 billet steel unless otherwise specified or indicated.

B. Bars or Rod Mats: ASTM A184.

C. Welded Wire Fabric for Reinforcement: ASTM A185.

D. Tie Wire: ASTM A82, fully annealed, copper-bearing steel wire, 16 gage minimum.

E. Chairs, Spacers, Supports, and Other Accessories: Standard manufacture conforming to ACI 315 fabricated from steel wire of required types and sizes. For reinforcement supported from grade, provide properly sized dense precast blocks of concrete.

2.03 FABRICATION OF REINFORCING BARS:

A. Comply with CRSI Manual of Standard Practice for Reinforced Concrete Construction for fabrication of reinforcing steel.

B. Bending and Forming: Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are not permitted. Provide only tested and permitted bar materials.

C. Welding: Provide only ASTM A706 steel where welding is indicated. Perform welding by the direct electric arc process in accordance with AWS D1.4 and specified low-hydrogen electrodes. Preheat 6 inches each side of joint. Protect joints from drafts during the cooling process; accelerated cooling is not permitted. Do not tack weld bars. Clean metal surfaces to be welded of loose scale and foreign material. Clean welds each time electrode is changed and chip burned edges before placing welds. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds deemed defective, using chisel, and replace with proper welding. Prequalification of welds shall be in accordance with CBC requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as indicated on reviewed Shop Drawings.

B. Before installation and just prior to placing concrete, clean reinforcing of loose scale, rust, oil, dirt and any coating that could reduce bond.

C. Accurately position, install, and secure reinforcing to prevent displacement during the placement of concrete.

D. Provide metal chairs to hold reinforcement the required distance above form bottoms. In beams and slab construction, provide chairs under top slab reinforcement as well as under bottom reinforcement. Space chairs so that reinforcement will not be displaced during installation. Provide metal spacers to secure proper spacing. Stirrups shall be accurately and securely wired to bars at both top and bottom. At slabs, footings, and beams in contact with earth, provide concrete blocks to support reinforcement at required distance above grade.

E. Install and secure reinforcement to maintain required clearance between parallel bars and between bars and forms. Lapped splices shall be installed wherever possible in a manner to provide required clearance between sets of bars. Stagger lapped splices. Dowels and bars extending through construction joints shall be secured in position against displacement before concrete is installed and subsequently cleaned of concrete encrustations while they are still soft.

F. Do not install reinforcing in supported slabs and beams until walls and columns have been installed to underside of slabs and beams or until construction joints have been thoroughly cleaned. Reinforcing shall be inspected before placement of concrete and cleaned as required.

G. Use deformed bars unless otherwise indicated, except for spiral reinforcement.

3.02 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cast-in-place normal weight and lightweight concrete, placement and finishing.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 32 1313: Site Concrete Work.

3. Section 03 3100: Concrete Forming and Accessories.

4. Section 03 2000: Concrete Reinforcing.

1.02 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.

2. ACI 301 – Specifications for Structural Concrete.

3. ACI 302.1R – Guide for Concrete Floor and Slab Construction.

4. ACI 305R - Specification for Hot Weather Concreting.

5. ACI 306.1 – Standard Specification for Cold Weather Concreting.

6. ACI 318 - Building Code Requirements for Structural Concrete, as modified by CBC Sections 1903A and 1908A.

B. American Society for Testing and Materials (ASTM) Standards:

1. ASTM C31 – Standard Specification for Making and Curing Concrete Test Specimens in the Field.

2. ASTM C33 - Standard Specification for Concrete Aggregates.

3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

5. ASTM C88 - Standard Test Method for Soundness of Aggregates by use of Sodium Sulphate or Magnesium Sulphate.

6. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

7. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

8. ASTM C150 - Standard Specification for Portland Cement.

9. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

10. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.

11. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

12. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

13. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).

14. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

15. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.

16. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

17. ASTM C567 - Standard Test Method for Determining Density of Structural Lightweight Concrete.

18. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

19. ASTM C845 - Standard Specification for Expansive Hydraulic Cement

20. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.

21. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

22. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

23. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures

24. ASTM C1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).

25. ASTM D1751 - Standard Test Method for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

26. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

27. ASTM E1155 - Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.

28. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

29. ASTM E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.03 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating locations of cast-in-place concrete Work and accessory items such as vapor barriers. Include details and locations of reinforcing, embedded items, and interfacing with other Work.

B. Mix Design Data: Submit concrete mix designs as specified herein and in Article 2.02.

1. Submit name, address and telephone number of the concrete production facility which the contractor intends to engage to design the concrete mixes. Submit name and qualifications of the proposed concrete technologist.

2. Mix Design: Submit a concrete mix design, stamped and signed by a civil or structural engineer licensed in the state of CA, for each strength and type of concrete indicated in the drawings or specified. Include water/cement ratio, source, size and amount of coarse aggregate and admixtures. Predict minimum compressive strength, maximum slump and air content percentage. Clearly indicate locations where each mix design will be used.

a. Water/cement ration for concrete slabs on grade shall be 0.50 maximum.

3. Test Reports: Submit copies of test reports showing that the proposed mixes produce concrete with the strengths and properties specified. Include tests for cement, aggregates and admixtures. Provide gradation analysis.

C. Material Samples: Submit Samples illustrating concrete finishes and hardeners, minimum 12-inch by 12-inch.

D. Certificates: Submit certification that each of the following conforms to the standards indicated:

1. Portland cement: ASTM C150.

2. Normal weight concrete aggregates: ASTM C33.

3. Lightweight concrete aggregates: ASTM C330.

4. Aggregates: Submit evidence that the aggregate is not reactive in the presence of cement alkalis. In the absence of evidence, aggregate shall be tested per ASTM C289. If results of test are other than innocuous, aggregates shall be tested per ASTM C1567 as reported per ACI 318 as modified by CBC, Section 1903A.3.

5. Curing materials: ASTM C171.

E. Admixtures: Submit product data for proposed concrete admixtures.

1.04 QUALITY ASSURANCE

A. Continuous inspection shall be provided at the batch plant and for transit-mixed concrete to run check sieve analysis of aggregate, check moisture content of fine aggregate, check design of mix, check cement being used with test reports, check loading of mixer trucks, and certify to quantities of materials placed in each mixer truck.

B. Inspection shall be performed by a representative of a testing laboratory selected by the OWNER. OWNER will pay for inspection costs. Notify the laboratory 24 hours in advance of time concrete is to be mixed. Notify the laboratory of postponement or cancellation of mixing within at least 24 hours of scheduling time.

C. CONTRACTOR shall assist the testing laboratory in obtaining and handling samples at the project site and at the source of materials.

D. Continuous batch plant inspection requirement may be waived in accordance with CBC Section 1704A.4.3. Waiver shall be in writing, including DSA approval. When batch plant inspection is waived by DSA, the following requirements shall be met:

1. Approved inspector of the testing laboratory shall check the first batching at the start of work and furnish mix proportions to the licensed weightmaster.

2. Licensed weightmaster shall positively identify materials as to quantity and certify to each load by a ticket.

3. Tickets shall be transmitted to the Inspector by a truck driver with load identified thereon. The Inspector will not accept the load without a load ticket identifying the mix and will keep a daily record of placements, identifying each truck, its load and time of receipt and approximate location of deposit in the structure and will transmit a copy of the daily record to DSA.

4. At the end of the project, the weightmaster shall furnish an affidavit to DSA certifying that all concrete furnished conforms in every particular to proportions established by mix designs.

E. Special Inspections and Tests shall be in accordance with CBC Chapter 17A, Reinforcement and Anchor testing per CBC Section 1916A and Specification Section 01 4523.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.

B. Packaged materials shall bear the manufacturers and brand name label, and shall be stored in their original unbroken package in a weather tight place until ready for use in the work.

1.06 PROJECT CONDITIONS

A. Cold Weather Requirements: Batching, mixing, delivering and placing of concrete in cold weather shall comply with the applicable requirements of ACI 306.1.

B. Hot Weather Requirements: Batching, mixing, delivering and placing of concrete in hot weather shall comply with the applicable requirements of ACI 305R.

C. Concrete temperature of freshly mixed concrete shall be determined per ASTM C1064.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C150. Portland Cement.

B. Aggregates: Conform to the following standards:

1. Normal weight concrete: ASTM C33.

2. Lightweight concrete: ASTM C330, with fine aggregates per ASTM C33.

3. Aggregate shall be tested for Potential Alkali Reactivity of Cement-Aggregate Combinations per ASTM C289.

4. Nominal maximum size of coarse aggregate shall be no larger than:

a. 1/5 the narrowest dimension between sides of forms, nor

b. 1/3 the depth of slabs, nor

c. 3/4 the clear spacing between individual reinforcing bars or wires, bundles of bars, individual tendons, or ducts.

d. CONTRACTOR may request the ARCHITECT and DSA waiver of the above limitations reported per ACI 318 as modified per CBC Section 1903A.3, provided that the workability and methods of consolidation are such that the concrete can be placed without honeycombs or voids.

C. Water: Water for concrete mixes, curing and cleaning shall be potable and free from deleterious matter.

D. Admixtures: Shall be shown capable of maintaining essentially the same composition and performance throughout the work as the product used in establishing concrete proportions in accordance with ACI 318, Section 3.6.

1. Admixtures containing chlorides or sulfides are not permitted.

2. Air-entraining admixtures shall comply with ASTM C260. Air-entrained admixtures shall not be used for floor slabs to receive steel trowel finish.

3. Admixtures for water reduction and setting time modification shall conform to ASTM C494.

4. Admixtures for producing flowing concrete shall conform to ASTM C1017.

5. Admixtures containing ASTM C845 expansive cements shall be compatible with the cement and produce no deleterious effects.

6. Silica fumes used as an admixture shall conform to ASTM C1240.

E. Reinforcement Fibers: Chop strands of alkali-resistant polypropylene or nylon fibers added to the concrete mix for protection against shrinkage cracks.

F. Expansion Joint Fillers: Preformed strips, non-extruding and resilient bituminous type, of thickness indicated, conforming to ASTM D1751.

G. Curing Paper: Shall conform to ASTM C171 and consist of two sheets of kraft paper cemented together with a bituminous material in which are embedded cords or strands of fiber running in both directions. The paper shall be light in color, shall be free of visible defects, with uniform appearance.

H. Floor Hardener: Water soluble, inorganic, silicate-based curing, hardening, sealing and dustproofing compound. Aquaseal W20 by Monopole Inc., Kure-N-Harden by BASF, Chem Hard by L&M, Liqui-Hard by W. R. Meadows, or equal.

I. Underlayment: Two component latex underlayment for filling low spots in concrete for both interior and exterior applications, from featheredge to a maximum of 3/8 inch in thickness. Underlayment shall be non-shrink and suitable for repairing exposed concrete surfaces and for underlayment of carpet, resilient, tile and quarry floor coverings. La-O-Tex by TexRite, Underlay C, RS by Mer-Krete Systems, Underlayment 962 by C-Cure, or equal.

J. Vapor Barrier: Refer to Section 07 2600, Vapor Barriers.

K. Stair Treads and Nosings: Two part stair tread and nosing with ribbed abrasive bars. Fabricated from 6063-T5 or 6063-T6 extruded aluminum, mill finish. Anti-slip abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Color shall extend uniformly throughout filler.

1. American Safety Tread: TP-311R.

2. Balco Inc.: DST-330.

3. Nystrom: STTB-P3.375E.

4. Wooster Products Inc.: WP-RN3SG.

5. Equal.

L. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a

minimum compressive strength of 7,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

2.02 CONCRETE MIX

A. Mix shall be signed and sealed by a Civil or Structural Engineer currently registered in the State of California.

B. Strength of Concrete: Strengths and types of concretes shall be as indicated in the Drawings. Unless otherwise indicated or specified, concrete shall be provided with minimum 28-day strength of 3000 psi (f'c).

C. The required strength and durability of concrete shall be determined by compliance with the proportioning, testing, mixing and placing provisions of CBC Sections 1905A.1 through 1905A.13. Concrete mix shall meet the durability requirements of ACI 318, Chapter 4.

D. Concrete proportioning shall be determined on the basis of field experience and/or trial mixtures shall in accordance with ACI 318, Section 5.3. Proportions of materials shall provide workability and consistency to permit concrete to be placed readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding.

E. Ready-Mixed Concrete: Mix and deliver in accordance with requirements of ASTM C94.

PART 3 - EXECUTION

3.01 GENERAL

A. Surfaces to receive concrete shall be free of debris, standing water, and any other deleterious substances before start of concrete placing.

B. Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hangers, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the Inspector at least 24 hours before placing concrete; do not place concrete until inspected by the Project Inspector.

C. Pouring Record: A record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by the ARCHITECT and DSA.

3.02 TOLERANCES

A. Concrete construction tolerances shall be as specified in ACI 117 and as modified herein.

B. Floor Flatness (F_F) and Floor Levelness (F_L) shall be as indicated below:

	Specified Overall Value	Minimum Local Value

	F_F	F_L	F_F	F_L
Slabs on ground: mechanical and electrical rooms, parking structures and mortar bed set tile and quarry flooring.	20	15	15	10
Slab on ground: carpet.	25	20	17	15
Slab on ground: thinset tile and resilient flooring.	35	25	24	17

C. Refer to ACI 302.1R, Tables 8.1 and 8.2 Slab on Ground and Suspended Flatness/Levelness Construction Guide, for recommended concrete placing and finishing methods.

D. Floor Flatness and Floor Levelness shall be tested in accordance to ASTM E1155. Floor measurements shall be made within 48 hours after slab installation, and shall precede removal of shores and forms.

3.03 PREPARATION

A. For installation of vapor barrier refer to Section 07 2600, Vapor Barriers.

B. Reglets and Rebates:

1. Form reglets and rebates in concrete to receive flashing, frames and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.

2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be 3/4 inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.

C. Screeds: Install screeds accurately and maintain at required grade or slab elevations after steel reinforcement has been installed, but before starting to place concrete. Install screeds adjacent to walls and in parallel rows not to exceed 8 feet on centers.

3.04 INSTALLATION

A. Conveying and Placing:

1. Concrete shall be placed only under direct observation of the Project Inspector. Do not place concrete outside of regular working hours, unless the Inspector has been notified at least 48 hours in advance.

2. Concrete shall be conveyed from mixer to location of final placement by methods that will prevent separation or loss of materials.

3. Concrete shall be placed as nearly as practicable to its final position to avoid segregation due to re-handling or flowing. No concrete that has partially hydrated or

has been contaminated by foreign materials shall be placed, nor shall re-tempered concrete or concrete which has been remixed after initial set be placed.

4. In placing concrete in columns, walls or thin sections, provide openings in forms, elephant trunks, tremies or other recognized devices, to prevent segregation and accumulation of partially hydrated concrete on forms or metal reinforcement above level of concrete being placed. Such devices shall be installed so that concrete will be dropped vertically. Unconfined vertical drop of concrete from end of such devices to final placement surface shall not exceed 6 feet.

5. Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.

6. Concrete shall be thoroughly consolidated by suitable means during placement, and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.

7. Where conditions make consolidation difficult or where reinforcement is congested, batches of mortar containing same proportions of cement, sand, and water as provided in the concrete, shall first be deposited in the forms to a depth of at least one inch.

B. Cold Weather:

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. All ground with which concrete is to come in contact shall be free from frost. No frozen materials or materials containing ice shall be used.

2. The temperature of concrete at the time of placement shall not be below the minimum temperatures given in Table 3.1 of ACI 306.1.

3. Concrete shall be maintained at a temperature of at least 50° F. for not less than 72 hours after placing or until it has thoroughly hardened. Cover concrete and provide sufficient heat as required. When necessary, aggregates shall be heated before mixing. Special precautions shall be taken for protection of transit-mixed concrete.

C. Hot Weather:

1. Concrete to be placed during hot weather shall comply with the requirements of ACI 318, Section 5.13.

2. Maintain concrete temperatures indicated in Table 2.1.5 of ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square feet of exposed concrete per hour.

3. Cool concrete using methods indicated in ACI 305R Appendix B.

4. Place and cure concrete as specified in ACI 305R Chapter 4.

D. Compaction and Screeding:

1. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.

2. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of coarse aggregate.

E. Floating and Troweling:

1. When concrete has hydrated sufficiently, it shall be floated to a compact and smooth surface. After floating, wait until concrete has reached proper consistency before troweling. Top surfaces shall receive at least 2 troweling operations with steel hand trowel. Prior to and during final troweling, apply a fine mist of water frequently with an atomizing type fog sprayer. Omit troweling for slabs to receive a separate cement finish.

2. For interior finish slabs, final troweling shall provide a hard, impervious, and non-slip surfaces, free from defects and blemishes. Finished surface shall be within tolerances indicated in Article 3.02. Avoid burnishing. Do not add cement or sand to absorb excess moisture.

   a. Floor of Walk-In Refrigerator: Finish as specified above, to a smooth finish.

   b. Floor of Gymnasium Locker Rooms: After floating, and while the surface is still plastic, provide a fine textured finish by drawing a fine fiber bristle broom uniformly over the surface in one direction only. Floors sloped for drainage should be brushed in the direction of flow.

3. Exterior Paving and Cement Walks: Finish as specified above, except surface shall be given a non-slip broom finish to match Sample reviewed by the ARCHITECT.

4. Vertical concrete surfaces shall be finished smooth and free from marks or other surface defects.

F. Curing:

1. Length of time, temperature and moisture conditions for curing concrete shall be in accordance with ACI 318, Section 5.11.

2. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing.

3. If weather is hot or surface has dried out, spray surface of concrete slabs and paving with fine mist of water, starting not later than 2 hours after final troweling and continuing until sunset. Surface of finish shall be kept continuously wet until curing medium has been installed.

4. Immediately after finishing, monolithic floor slabs shall be covered with curing paper. Paper shall be lapped 4 inches at joints and sealed with waterproof sealer. Edges

shall be cemented to finish. Repair or replace paper damaged during construction operations.

G. Filling, Leveling and Patching:

1. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to required tolerances. Low spots shall be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.

2. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.

H. Cement Base: Cement base shall be of the height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemically inert mineral oxide pigment in the mix.

3.05 FINISHING

A. Soda and Acid Wash: Concrete surfaces to receive plaster, paint or other finish, and which have been formed by oil coated forms, shall be scrubbed with a solution of 1-1/2 pounds of caustic soda to one gallon of water. Surfaces where smooth wood or waste molds have been furnished shall be scrubbed with a solution of 20 percent muriatic acid. Wash with clean water after scrubbing.

B. Sacking: Exposed concrete curbs, walls, and other surfaces shall be sacked by an application of Portland cement grout, floated, and rubbed. Sacking shall not be performed until patching and filling of holes has been completed. Entire sacking operation for any continuous area shall be started and completed within the same day.

1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having consistency of thick paint. Wet surface of concrete sufficiently to prevent absorption of water from grout. Apply grout uniformly with a brush or spray gun, then immediately float surface with a cork or other suitable float, scouring wall vigorously.

2. While grout is still plastic, finish surface with a sponge-rubber float, removing excess grout. Allow surface to dry thoroughly, then rub vigorously with dry burlap to completely remove dried grout. No visible film or grout shall remain after rubbing with burlap.

C. Sandblasting: Exterior concrete surfaces to receive stucco dash coat finish, where plywood or other smooth forms have been furnished, shall be uniformly sand-blasted with sharp quartz sand under sufficient air pressure to remove dirt, form oil and other foreign materials, and roughen surface to provide a proper bond. Such surfaces shall be thoroughly washed with clean water after sandblasting.

D. Abrasive: Concrete stair treads, landings, ramps and steps on interior and exterior of buildings, and interior exposed concrete floors in shop buildings shall receive an abrasive finish.

E. Floor Hardener: Exposed interior concrete floors throughout shall be treated with floor hardener.

1. Protect adjacent surfaces. Clean surfaces to receive treatment in accordance with manufacturer's instructions, ensuring that all stains, oil, grease, form release agents, laitance, dust and dirt are removed prior to application.

2. Apply hardener in accordance with manufacturer's instructions as soon as concrete is firm enough to work on after final troweling.

F. Cement Grout and Dry-Pack Concrete: Cement grout shall be mixed at the Project site and shall be composed of one volume of Portland cement and 2-1/2 volumes of fine aggregate. Materials shall be mixed dry with sufficient water added to make mixture flow under its own weight. When grout is used as a dry pack concrete, add sufficient water to provide a stiff mixture, which can be molded into a sphere.

G. Broom Finish: Exterior stair treads and landings shall be provided with a non-slip broom finish in addition to abrasive finish specified.

H. Abrasive Stair Nosing: Nosing shall be installed according to manufacturers written recommendations.

3.06 EXPANSION AND CONSTRUCTION JOINTS

A. Construction Joints: Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:

1. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.

2. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.

3. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.

B. Expansion Joints: Provide expansion joints where indicated in walks and exterior slabs. Space approximately 20 feet apart, unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 3/8 inch thick, unless otherwise indicated.

C. Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated,

shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

3.07 TESTING

A. Molded Cylinder Tests:

1. Inspector or testing lab personnel will prepare cylinders and perform slump tests. Samples for concrete strength shall be taken in accordance to ASTM C172. Each cylinder shall be dated, given a number, point in structure from which sample was obtained, mix design number, mix design strength and result of accompanying slump test noted.

2. Separate tests of molded concrete cylinders obtained at same place and time shall be made at age of three days, seven days, and 28 days. A strength test shall be the average of the compressive strength of two cylinders, obtained from the same sample of concrete and tested at 28 days or at test age designated for determination of f'c.

3. Test cylinders shall be prepared at the Project site and stored in testing laboratory in accordance with ASTM C31, and tested in accordance with ASTM C39.

B. Core Test: At request of the ARCHITECT, cores of hardened concrete shall be cut from portions of hydrated structures for testing, in accordance with CBC and ASTM C42.

1. Provide 4 inch diameter cores at representative places throughout the structure as designated by the ARCHITECT.

2. In general, provide sufficient cores to represent concrete placed with at least one core for each 4,000 square feet of building area, and at least 3 cores total for each Project.

3. Where cores have been removed, fill voids with drypack, and patch the finish to match the adjacent existing surfaces.

C. Concrete Consistency: Measure consistency according to ASTM C143. Test twice each day or partial day's run of the mixer.

D. Adjustment of Mix: If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, falls below minimum 28 days compressive strength specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.

E. Air Content Testing: Measure in accordance to ASTM C173 or ASTM C231, for each composite sample taken in accordance to ASTM C172.

F. Defective Concrete:

1. Should strength of any grade of concrete, for any portion of Work indicated by tests of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective Work and shall be replaced or adequately strengthened in a manner acceptable to the ARCHITECT and DSA.

2. Concrete Work that is not formed as indicated, is not true within 1/250 of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, contains sawdust shavings, wood or embedded debris, or does not fully conform to Contract provisions, shall be deemed to be defective Work and shall be removed and replaced.

G. Concrete for Equipment Pads, Mechanical and Electrical Work: Unless otherwise indicated, strength shall have a minimum f'c = 3,000 psi. Exposed concrete shall be provided with a hand trowel finish with radius corners and edges. Form and place concrete where necessary as described in Section 03 1000 Concrete Forming and Accessories, and reinforced as described in Section 03 2000 Concrete Reinforcing. Calcium chloride shall not be furnished in any concrete mix provided for the installation of underground electrical conduits. For concrete encasement of more than one conduit, furnish 3/4 inch maximum aggregate.

3.08 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.09 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 03 1000

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete as indicated.

2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 03 2000: Concrete Reinforcing.

3. Section 03 3000: Cast-In-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 318 – Building Code Requirements for Structural Concrete, Chapter 6, Formwork, Embedded Pipes, and Construction Joints.

2. ACI 347 – Guide to Formwork for Concrete.

B. American Plywood Association (APA):

1. Form No. V345 - Concrete Forming Design/Construction Guide.

C. National Institute of Standards and Technology (NIST):

1. NIST Voluntary Product Standard PS 1.

1.03 SUBMITTALS

A. Submit detailed structural calculations and drawings approved and signed by a California registered Civil Engineer where individual horizontal span lengths exceed 16 feet, or shoring occurs. For all other falsework and shoring submit layout signed by California registered Civil Engineer, manufacturer's authorized representative or a licensed contractor experienced in the usage and erection of falsework and vertical shoring. A copy of the plans and calculation shall be available at the jobsite at all times.

B. Shop Drawings: Submit Shop Drawings indicating locations of forms, construction and expansion joints, embedded items, and accessories.

C. Product Data: Submit manufacturer's Product Data for form materials and accessories.

1.04 REGULATORY REQUIREMENTS

A. California Building Code (CBC), Chapter 19A.

B. California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 4, Construction Safety Orders, Article 6, Excavations, Sections 1713 and 1717.

1.05 DELIVERY, STORAGE AND HANDLING

A. Storage shall prevent damage and permit access to materials for inspection and identification.

PART 2 - PRODUCTS

2.01 GENERAL

A. Form materials may be reused during progress of the Work provided they are completely cleaned and reconditioned, recoated for each use, capable of producing formwork of required quality, and are structurally sound.

B. Form Lumber: WCLIB Construction Grade or Better, WWPA No. 1 or Better.

C. Plywood: NIST Voluntary Product Standard PS 1, Group 1, Exterior Grade B-B Plyform or better, minimum 5-ply and 3/4 inch thick for exposed locations and at least 5/8 inch thick for unexposed locations, grade marked, not mill oiled. Furnished plywood with medium or high density overlay is permitted.

D. Coated Form Plywood: For exposed painted concrete, plastic overlaid plywood of grade specified above, factory coated with a form coating and release agent Nox-crete", or equal.

E. Special Forms: For exposed integrally-colored concrete, plywood as above with high density overlay, plywood with integral structural hardboard facing or fibrous glass reinforced plastic facing, providing specified finish.

F. For Exposed Concrete Finish:

1. Plywood: New, waterproof, synthetic resin bonded, exterior type Douglas fir or Southern pine plywood manufactured especially for concrete formwork and conforming to NIST Voluntary Product Standard PS 1, Grade B-B grade, Class I.

2. Glass-Fiber-Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surfaces.

3. Steel: Minimum 16 gage sheet, well matched, tight fitting, stiffened to support weight of concrete, without deflection detrimental to tolerances and appearances of finished concrete surfaces.

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

H. Form Coating: Non-staining clear coating free from oil, silicone, wax, not grain-raising, "Formshield" by A.C. Horn, Inc., "Release" by Edoco/Dayton Superior, "Cast-Off" by Sonneborn/BASF Building Systems or equal. Where form liners are furnished, provide form coatings recommended by form liner manufacturer.

I. Form Liner: Rigid or resilient type by L.M. Scofield, Symons, Greenstreak, or equal.

J. Void Forms: Manufactured by SureVoid Products, Inc., Sonotube, Void Form International, or equal. Forms shall be "WallVoid" for temporary support of concrete walls and grade beams spanning between supports, and "SlabVoid" for creating gaps between concrete slabs or steps and underlying soils. Void forms shall be fabricated of corrugated paper with moisture resistant exterior, and shall be capable of withstanding working load of 1,500 psf. Provide accessories as required.

PART 3 - EXECUTION

3.01 GENERAL

A. Forms shall be constructed so as to shape final concrete structure conforming to shape, lines and dimensions of members required by Drawings and Specifications, and shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape. Forms and their supports shall be designed so that previously placed structures will not be damaged.

B. Use form coating at all surfaces in contact with concrete.

3.02 TOLERANCES

A. Permitted abrupt or gradual irregularities in formed surfaces as measured within a 5 feet length with a straightedge shall per ACI 347, Table 3.1:

Class of Surface			
A	B	C	D
1/8 inch	1/4 inch	1/2 inch	1 inch

1. Class A: Use for concrete surfaces prominently exposed to public view.

2. Class B: Use for coarse-textured concrete-formed surfaces intended to receive plaster, stucco or wainscoting.

3. Class C: Use as a general standard for permanently exposed surfaces where other finishes are not specified.

4. Class D: Use for surfaces where roughness is not objectionable and will be permanently concealed.

3.03 ERECTION

A. Plywood shall be installed with horizontal joints level, vertical joints plumb and with joints tight. Back joints by studs or solid blocking, and fill where necessary for smoothness. Reused plywood shall be thoroughly cleaned, damaged edges or surfaces repaired and both sides and edges oiled with colorless form oil. Nail plywood along edges, and to intermediate supports, with common wire nails spaced as necessary to maintain alignment and prevent warping.

B. Openings for Cleaning: Provide temporary openings at points in formwork to facilitate cleaning and inspection. At base of walls and wide piers, bottom form board on one face for entire length shall be omitted until form has been cleaned and inspected.

C. Chamfers: Provide 3/4 inch by 3/4 inch chamfer strips for all exposed concrete corners and edges unless otherwise indicated.

D. Reglets and Rebates: As specified in Section 03 3000: Cast-In-Place Concrete.

3.04 REMOVAL OF FORMS

A. Forms shall not be removed until concrete has sufficiently hydrated to maintain its integrity and not be damaged by form removal operations. Unless noted otherwise and/or permitted by the Architect, columns and wall forms shall not be removed in less than five days, floor slabs in less than seven days, beams and girders in less than 15 days, pan forms for joists may be removed after three days, but joist centering shall not be removed until after 15 days, and ramp, landing, steps and floor slabs shall not be removed in less than seven days. Shoring shall not be removed until member has acquired sufficient strength to support its weight, load upon it, and added load of construction.

B. Compressive strength of in-place concrete shall be determined by testing field-cured specimens representative of concrete location or members, as specified in Section 03 3000: Cast-In-Place Concrete.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 13 3416

PRESS BOX PLATFORM AND PRESS BOX

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. Provide labor, material, equipment and supervision necessary to complete installation of Press Box Platform and stairs, including the following:
   1. Steel Substructure
   2. Decking System
   3. Concrete Foundation
   4. Press Box Support Structure
   5. Press Box

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturers must have ten years of experience in the manufacture of bleachers and grandstands; manufacturer must exhibit proof of business existence for the past five years with documentation; welders must be AWS certified.
B. Installer Qualifications: Experienced in the proper installation of grandstands and press boxes.
C. Source Quality Control: Mill Test Certification.

1.03 SUBMITTALS

A. Manufacturer's Product Data: Submit manufacturer's descriptive product data for project.
B. Shop Drawings: Manufacturer to submit shop drawings sealed by a registered engineer and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the applicable code and relevant laws.
C. Certificates:
   1. Insurance Certificate
   2. Bid Bond
D. Product Sample: Submit one 18-inch seat sample.
E. Color Sample: If applicable, submit sample.

1.04 SITE CONDITIONS

A. Field Site:
   1. Owner to make site accessible.
   2. Owner to verify site locations, benchmarks.
B. Underground Utility Line: Owner to clearly mark all underground utilities and obstructions and Owner to relocate all that conflict with grandstand.
C. Soil Test: Furnished by Owner.

1.05 BUILDING CODES

A. Must meet or exceed all State and Local applicable codes and in compliance with the California Building Code and Title 24 CBC.

1.06 WARRANTY

A. Press Box platform with stair access shall be under warranty for a period of one (1) year beginning at Date of Substantial Completion for Projects installed by the manufacturer. The warranty will provide for repair or replacement of failed components due to defect in materials and workmanship of installation for the specified period. This warranty excludes any other defects resulting from abnormal use in service, vandalism, weathering, oxidation, accidental or intentional damage or any occurrences beyond the manufacturer's control.

1.07 MAINTENANCE

A. Owner is to conduct annual inspection and required maintenance of grandstand to assure safe conditions. It is also recommended that a professional engineer or registered architect perform inspections biennially.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Southern Bleacher Company (800) 433-0912. Horizontal Beam Design.

Other manufacturers seeking to be approved must submit product literature on horizontal beam design to the Owner for review and receive approval from Owner seven days prior to bid date.

2.02 PRESS BOX STEEL STRUCTURE

A. Product Description
1. Horizontal Beam Design
Press Box Support Structure 8'x 36'.
Press Box 8' x 30'.

2. Vertical columns are placed 24 feet 0 inches on center laterally and 5' feet on center front to back.

3. Horizontal beams are wide flange beams.

4. Traverse bays braced with angle bracing at each column row.

5. Stringers are wide flange with steel angle rise and depth fabrication and are placed 6 feet on center.

6. Entry stairs to be firmly anchored to uniformly poured concrete bases.
a. Stair rise: 6 inches with aluminum closure and contrasting aluminum stair nose.
b. Stair tread depth: 11 inches.
c. Guardrails: As required by code.
d. Stairs to have handrail extension. The handgrip portion of handrails shall not be less than 1 1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no

sharp corners. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the nosing of treads and landings. Where handrails are not continuous between flights, the handrails shall extend horizontally at least 12 inches beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. Ends shall be returned or shall terminate in newel posts or safety terminals.

7. Guardrailing: To be at all sides of entry stairs, and landings. Railing to be anodized aluminum with end plugs at ends of straight runs and/or elbows at corner. All guardrails shall be secured to angle rail risers by galvanized fasteners. Railing shall be at heights as required by code for its location on the grandstand. Guard railing shall include intermediate railing, or galvanized chain link fencing fastened in place with galvanized fasteners and aluminum ties.

B. Materials/Finishes
   1. Substructures:
      a. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.
      b. Shop connections are seal welds.
      c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.
      d. Painted steel finish is unacceptable.

   2. Extruded Aluminum:
      a. Riser Planks, and Railing are extruded aluminum alloy, 6063-T6.
         (1) Clear anodized 204R1, AA-M10C22A31, Class II finish
         (2) Coating (Optional with additional cost):
            (a) Factory applied, baked-on Kynar or Hylar/acrylic resin based paint coating, Dur-Kyn, as manufactured by the Valspar Corporation. Dur-Kyn meets or exceeds the physical and performance properties of AAMA 2603. (Specify color).
            (b) Powder Coated or other paint system meeting AAMA 603.8-92 specifications with a hardness rating of 2H. (Specify Color).
      b. Tread planks are extruded aluminum alloy 6063-T6 mill finish.
      c. Railing: Extruded aluminum alloy, 6063-T6 clear anodized 204R1, AA-M10C22A31, Class II.

   3. Accessories:
      a. Channel End Caps: Aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II.
      b. Cast End Caps: Aluminum 319 alloy, cast finish. (Required for backrest and RS plank only)
      c. Hardware:
         (1) Bolts, Nuts: Hot-dipped galvanized or mechanically galvanized.
         (2) Hold-down Clip Assembly: Aluminum alloy 6005A-T6, mill finish.
         (3) Structural Hardware: Equal to or greater than hot-dipped galvanized ASTM-A307. No connections utilizing high strength bolts are classed as slip critical.
      d. Aisle Nose and Stair Nose: Aluminum alloy, 6063-T6, non-skid black powder coated finish or other paint system meeting AAMA 603.8-92 specifications with a hardness rating of 2H.

C. Fabrication:
   1. Design Load:
      a. Tread and Seat Area: 100 psf uniform live load.
      b. Seat (Vertical): 120 lbs/lf.

c. Seat (Horizontal Sway): 24 lbs/lf parallel and 10 lbs/lf perpendicular to seat.
d. Handrail and Guardrail: 50 lbs/lf in any direction.
e. Handrail and Guardrail: 200 lbs concentrated in any direction.
f. Snow Loads: As per State adopted code.
g. Wind Loads: As per State adopted code.
h. Seismic Loads: As per State adopted code.

2. All manufactured connections to be shop welded.
a. Manufactured by certified welders conforming to AWS Standards.

These specifications serve as a template only and items listed may or may not apply to your project. Please call a Southern Bleacher representative at 800-433-0912 for technical assistance in preparing specifications.

2.03 PRESS BOX

A. Product Description: Type II Construction
1. Press Box Support Structure: Independently supported but connected to rear of grandstand. Support Structure to be 36’ wide x 8 feet long with 6’ landing and stairs to grade on 1 end.

2. Press Box Dimensions: 30’ feet wide x 8’ long.

3. Filming Area/Observation Deck located on Press Box roof.
4. Press Box to be of open construction, allowing inspection of electrical wiring, switches and other components without destructive disassembly.

B. Materials/Finishes
1. Press Box Support Structure:
a. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.

b. Shop connections are seal welds.

c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.

2. Press Box: All materials shall be new and shall comply with ASTM specifications.
a. Floor
(1) Main support to be a galvanized steel floor frame sized to support structure and 29 ga metal belly pan for support of insulation.
(2) Floor to be INTERLOCK Aluminum Decking System, extruded aluminum alloy 6063-T6, mill finish. Attach Decking System to steel floor frame with mechanical fasteners at end of plank and at intermediate supports. (Tongue & Groove or Standard extrusion is not acceptable.)
(3) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation R-13, 3 1/2 inches thick. Batt or roll as manufactured by Johns Manville, or equal.

b. Wall Structure
(1) 4 inch x 4 inch x 11 gauge square tubing with maximum span of 14 feet on front wall and maximum span of 6 feet on back wall and 4 inch x 2 1/2 inch x 14 gauge steel "cees" with maximum spacing of 5 feet for all walls with siding. Spans greater than these require engineered calculations for design.

a) Steel framing shapes to meet one of the following ASTM's, A500 Grade A or B 45 ksi, A36 50ksi, A1011 CS Type B.

(2) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation R-13, 3 1/2 inches thick. Batt or roll as manufactured by Johns Manville or equal.

(3) Interior Finish
(a) 1/2 or 5/8 inch vinyl coated gypsum panels (as required), Gold Bond vinyl-surfaced Durasan. Color - Harvest Cotton.
(b) Cove Base: Vinyl 4 inches x .080. color – Nubian or Black Brown

(4) Exterior Finish
(a) 26 gauge prefinished R-Panel paneling as manufactured by MBCI, Signature 200 color series, or equal.
(b) Wall panels are attached with #12 TEK screws - 6” O.C. at the top, midpoint and bottom of the panels.
(c) Lap screws are placed at each end of the panels, at the intermediate supports, and at the mid point between supports (TEK #14).
(d) All fasteners to be painted same color as exterior paneling.

c. Roof Structure
(1) 4 inch x 4 inch x 11 gauge square tubing with maximum spacing of 6 feet on center and 4 inches x 2 1/2 inches x 14 gauge steel "cees" with maximum spacing of 2 feet on center.
(2) Roof: 1/8 inch fourway steel plate roof, continuous welded seams coated with acrylic metal primer as manufactured by Coronado and 36 mils of acrylink roof coating as manufactured by Isothermal Protective Coatings, or equal. Plate is welded on one side of rafters not located at seams and both sides of rafters located at seams with 2 inch long 1/2 inch fillet weld on 12 inch centers.
(3) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation, R-19 (minimum) 6 inches thick. Batt or roll as manufactured by Johns Manville or equal.
(4) Cornice: 26 gauge steel prefinished to match metal siding.
(5) Ceiling: 24 inch x 24 inch x 5/8 inch acoustical lay in ceiling tile with removable tiles, per 2019 CBC, applicable category for seismic zone. ref. DSA IR 25-2.

d. Exterior Door(s)
(1) Full flush steel construction with hollow or polystyrene core. 18 gauge skin sheets. Dimensions: 3 feet 0 inches x 6 feet 8 inches. Color: Coordinated with press box siding color.
(2) Steel door frame (16 gauge) complete with 1/2 inch threshold and weather-stripping.
(3) Exterior Hardware: Yale 546F Exterior Trim, or equal. Handles shall be lever type that allow operation without tight grasping or twisting of the wrist. Keyed alike locks.
(4) Interior Hardware: Yale 2100 Exit Device, or equal. Handle shall be panic bar that allows for opening without any grasping, twisting or turning.

e. Interior Door
(1) Interior Hollow Core Birch Unit. Dimensions: 3 feet 0 inches x 6 feet 8 inches.

(2) Hardware: Handles shall be lever type that allow operation without tight grasping or twisting of the wrist.

f. Interior Walls
(1) Framing to be steel galvanized studs (25 gauge) 1 1/4 inch x 3 5/8 inch, maximum 2 feet on center.
(2) Finishes to be consistent with all other interior finishes.

g. Windows
(1) Frame: Extruded aluminum single hung, vertical sliding unit**,** thermal break.
(2) Sash: Tilt toward inside for easy cleaning.
(3) Glazing: Clear tempered panes.
(4) Dimensions of each unit: Dependent on compartment size. At interior wall locations or structural support locations the dimension between windows shall be no greater than 6 inches.
(5) Finish: Electrostatically applied acrylic enamel.

h. Work Bench
(1) 1 inch thick x 21 inch wide clear anodized aluminum work bench supported by 4 inch x 2 1/2 inch x 14 gauge steel. Countertops heights shall be constructed to allow wheelchair usage at all locations.

i. Painting: Materials equal to Coronado, or equal.
(1) Surfaces: Exterior Door(s), Door Frame(s)
(a) Primer: Applied by Door Manufacturer.
(b) Finish: 2 coats acrylic latex semi-gloss enamel applied by press box manufacturer.
(2) Surfaces: Interior Doors (if applicable)
(a) Primer: Jones Blair Interior Exterior Latex, or equal.
(b) Finish: 2 coats acrylic latex semi-gloss enamel.
(3) Surfaces: Exterior Siding
(a) Primer: Applied by Siding Manufacturer.
(b) Finish: Applied by Siding Manufacturer.
(c) Touchup: If applicable
(4) Surfaces: Wall and Roof Structure
(a) Primer: Coronado DTM Industrial 180-11 acrylic metal primer applied after welding, or equal.

j. Caulking: Sonneborn NP1 – Polyurethane sealant, All temperature, UV resistant, or equal. Silicone products are not acceptable.

k. Electrical
(1) Submittal drawing shall indicate devices and circuitry.
(2) Fixtures: LED 1' x 4' lay-in design as manufactured by Lithonia Lighting, or equal. Fixtures shall be located above countertop and be maximized to full length of compartment space.
(3) Wiring to be in EMT, flexible metal conduit or surface raceway. N.E.C. breaker panel to be 100 amp flush or surface mounted on wall with 1 1/4 inch conduit stubbed out bottom of press box or 2 inch rigid conduit to be stubbed out at back wall of press box ready for service line to be connected. (Service line to Press Box is responsibility of Owner).
(4) Electrical outlet(s) installed per NEC shall be standard duty. All outlets shall be surface or flush mounted.
(5) Sound, Telephone, Clock, Field Communication: Empty single or double outlet boxes (as required) per N.E.C. with 3/4 inch conduit stubbed out

bottom of Press Box for use of Owner. Outlet boxes to be flush mounted into wall. Any wiring completed on-site will be responsibility of such contractor for inspections. Quantity. Two will be provided. Owner shall indicate additional boxes needed.

(6) (Optional) Filming Area/Observation Deck: Weathertight outlet box for cameras. Quantity: One. Owner shall indicate additional outlets needed.

l. Filming Area/Observation Deck Access:

(a) Roof hatch with OSHA-rated aluminum ladder mounted to an interior back wall.

(2) Roof guardrailing to be 42" above walking surface around perimeter of deck attached to 5/8 inch galvanized studs to be welded to roof support structure. The guardrailing to include anodized aluminum with 9 gauge galvanized chain link fencing fastened in place with galvanized fasteners and aluminum ties.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All work performed by technicians experienced in bleacher seating installation.
B. Project as per approved shop drawings.

3.02 FIELD QUALITY CONTROL

A. Foundation: Footings for the press box base shall provide sufficient bearing area at bottom to support all loads of the press box and base. Depth and design of footings shall be determined by Owner supplied soil test. Hot-dipped galvanized anchor bolts shall be secured in the concrete footings. Concrete shall attain working strength of 3,000 psi.

3.03 CLEAN-UP

A. Clean up all debris caused by work of this section.

B. The Owner, Architect and Contractor acknowledge and accept that mill finish aluminum as specified will have water stains present from transportation and storage during installation. Removal of these stains is not part of this contract.

C. Stand to be broom cleaned at completion.

END OF SECTION

SECTION 26 0500

ELECTRICAL GENERAL PROVISIONS

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 Sub-Contractors 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.

1. The Contract Document terms “Provide”, “Provided”, “Providing”, are each defined to mean individually and collectively: Contractor shall furnish, and Contractor shall install, and Contractor shall connect.

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 Owner’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 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.

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 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.

1. Pothole 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.

2. In-buildings employ raceway/circuit tracers, x-ray visual detection, RF/ultrasound, electromagnetic circuit detection to avoid damaging existing hidden conditions.

3. Repair/replace, without additional cost to the Contract, and to the satisfaction of the Owner any existing work damaged that was identified in the Record Drawings provided; Identified by the Owner's Representative; Identified by In-Building Investigation; Identified by the Underground Detection Services performed; or any existing work damaged as a result of failure to comply with all the Referenced Requirements.

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, trenching and 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 Owner's Representative to review existing underground conditions.

d. The proposed location and 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 Owner any existing work damaged that was identified in the record Drawings provided; Identified by the Owner'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 Owner, the Owner's Representative, the Architect/Engineer. The Owner, the Owner's Representative, and the Owner'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 AIR CONDITIONING, HEATING, AND PLUMBING EQUIPMENT WIRING

Provide electrical work, materials, and control components required for proper operation of the air conditioning, heating and plumbing systems as indicated on the Electrical, Mechanical, and Plumbing Contract Documents and specified herein.

1.05 QUALITY ASSURANCE

A. Work and materials shall be in full accordance with the latest Recommendations, 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 California Building Code – CBC.

6. National Fire Protection Agency – NFPA.

7. National Fire Alarm Code – NFAC/NFPA 72.

8. Underwriter's Laboratory – UL.

9. Other applicable State and Local Government Agencies Laws and Regulations.

10. 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-90: Recommended Practices for Commissioning Building Electrical Systems

    c. NECA/NEIS-101: Standard for installing Steel Conduit (Rigid, IMC, etc.)

    d. NECA/NEIS-111: Recommended Practice installing Nonmetallic Race-ways

    e. NECA/FOA-301: Standards for installing and Testing Fiber Optic Cables

    f. NECA/NEIS-305: Standard for Fire Alarm System Job Practice

    g. NECA/NEIS–331: Standards for installing Building and Service Entrance Grounding

    h. NECA/NEIS-407: Recommended Practice for installing Panelboards

    i. NEIS/NECA and IESNA-500: Recommended Practice for installing Indoor Commercial Lighting Systems

    j. NEIS/NECA and IESNA-501: Recommended Practice for installing Exterior Lighting Systems

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 Contractor's 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.

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 Owner 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 or not 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 submitting 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.

3. 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 3-ring binders. Divider tabs shall be provided in the 3-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.

4. The time required to review and comment on the Contractor's submittals will not be less than 14 calendar days, or more than 21 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.

5. Shop Drawings shall include the Manufacturers projected days for shipment from the factory of completed equipment, after the Contractor releases the equipment for production. 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 Owner's Representative of any changes in delivery, which would affect the project completion date.

6. 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: 05/12/98 Submittal #4 Contents: Branch Circuit Panelboards Sheet #E5.1 and Transformers Specification Section 260501 Paragraph 2.11, etc.).

    b. Each resubmittal shall be dated: with original submittal date and resubmittal transmission 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: 05/12/98 Resubmittal Date: 10/09/98 Original Submittal #4 Resubmittal Revision R2 Contents: Transformer Resubmittal Specification Section 260501 Paragraph 2.11, etc.).

c. Contractor shall provide a written response narrative with each resubmittal. Describe each response-action, resubmittal addition, change 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 Owner's Representative, a fee for the Owner'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 Owner.

2. Maintenance and operating manuals shall be bound in three ring, hard-cover, plastic binders with table of contents. Manuals shall be delivered to the Owner'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 Owner'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 Owner'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 performed.

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 Owner 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 Owner’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 AASHO-H20 traffic loading.

3. Provide a minimum of two 100% open lane(s) (12 feet 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, rated UV-resistant for wet locations and outdoor locations, fade resistant. 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 12-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.

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 inside 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 hereinafter described and further directed by the Owner'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 Owner's Representative for review, six copies.

1. All equipment and Personnel required for set-up and testing shall be provided by the Contractor.

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 and arc-flash studies, 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 Owner'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 Owner's Representative for review.

2. Ampere and voltage measurements 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 Owner'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 Owner'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 Owner's Representative.

F. State of California Title-24 Testing

1. Mandatory California Title-24 Building Energy Code, Part-6 acceptance testing. Shall insure those respective systems properly installed and functioning, all in conformance with Title-24.

2. Refer to Process Guide to Acceptance Testing, published by the State of California, complete the testing and documentation.

3. Perform California Title-24 Testing and Certification. Submit the completed Certification of acceptance documentation to the AHJ.

G. 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 Owner's Representative.

3. All ground connections shall be completed and identified. Perform and successfully complete all required megger and ground resistance tests.

4. Low voltage/signal circuits, line voltage branch circuits and feeders shall be connected, tested 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 abrasives over spray removed and equipment vacuumed clean. The Owner'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 line voltage and low voltage/signal electrical equipment rooms shall be provided with locks 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-Flash studies shall be complete for circuit breakers, ground relays set, and circuit relay sets, fuses; set-up, tested and calibrated accordingly. Protection settings for all devices shall be completed and tested.

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 Owner and performed only after consultation with the Owner'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 Owner.

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 Owner 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 Owner's Representative a minimum of 3-weeks in advance, for any proposed electrical outage.

1.13 SPARE FUSES

Provide three spare fuses for each size and type to match the installed fuses where the fuses are provided as part of the Contract. Provide spare fuse holders on inside door of each respective fuse compartment. Provide engraved nameplate on front of fuse access door indicating fuse type/ catalog number ampere rating and Manufacturer of fuse.

1.14 ELECTRICAL WORK CLOSEOUT

A. Prepare the following items and submit to the Owner's Representative before final acceptance.

1. Two copies of all test results as required under this Section.

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 Owner's Representative when requested.

5. Notify the Owner'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 Owner'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, busways, 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.

END OF SECTION 26 0500
021323/1126014

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 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 quantities 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-inch 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.

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-inch square by 2.125-inch-deep minimum with two gang single gang] gang extension ring on flush boxes.

    b. Combination signal/telephone/data or computer outlets: 4.69-inch 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).

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.

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 pull boxes: 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 pull boxes 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-Sping” 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 pull box to indicate services within pull box (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-inches 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 Dukseal.

7. As manufactured by Jensen Precast, or Oldcastle Precast.

2.03 SWITCHES, WIRING DEVICES

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 Owner’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 out-let 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

Manufacturer	Toggle Type	Lock Type
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

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

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

Manufacturer	Toggle Type	Lock Type
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

Manufacturer	Toggle Type	Lock Type
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

Manufacturer	3-Position Regular	3-Position Lock
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

	Toggle Type		Lock Type	
Manufacturer	1-Pole	2-Pole	1-Pole	2-Pole
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 LIGHTING CONTROL DIMMER SWITCHES (ARCHITECTURAL DIMMING)

A. LED Lamp Dimmers

1. Shall be specifically designed and rated for dimming Solid State Lighting – LED (SSL, Light Emitting Diode), both power supply/drivers and lamps. Dimming compatible solid state electronic power supplies/drivers.

2. LED lamps with self-contained power supplies inside each lamp shall be compatible with the dimming system and the dimming system shall be compatible with the lamp/driver power supply. Shop Drawing, submit Manufacturer's compatibility certificate.

2.05 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.

2. All receptacles shall be same Manufacturer.

3. Receptacle color as selected by Owner'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, provide tamper resistant receptacles in buildings containing dormitories, guestrooms, housing/residences, condominiums, apartments, dwellings, hotels/motels, secondary schools K through 12th grade, childcare/daycare

/kindergarten, hospital pediatric-care units and other locations required by AHJ.

b. The electrical receptacles shall be rated “Tamper-Resistant-Receptacle” (TR), UL-TR (RTRT). 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. Modify Manufacturer’s catalog number descriptions, shall include all-weather-resistant UL listing and labeling:

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 Weatherproof (W.P.).

10. “Split-Wire” duplex convenience receptacles. Each split-wire receptacle plug connects on independent common circuit. Provide nameplate or graphic on face of receptacle describing the receptacle function and control source. Comply with California Title-24 and ASHRAE-90.1, latest revisions.

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

	Manufacturer	NEMA 5-15R	NEMA 5-20R	NEMA 5-20R-GFCI
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 weatherproof, gasketed, key locking tamper resistant, wet location.

3. Outdoor, flush mount outlet with hinged, key-locking, weather-proof cover 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" condulet watertight cast metal body, with weather-proof 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.

2.06 PLATES

A. Metal cover plates for devices

1. Provide cover plates for every line voltage and low voltage switch, receptacle, telephone, computer, television, signal and other device outlets.

a. All line voltage circuit plates shall be metal, 0.040-inch stainless steel Type 302 alloy, composed of 18% chromium and 8% nickel.

b. Plates for low voltage signal systems may be metal or non-metal. Non-metal plates shall be high-abuse, hard-service and high-impact resistant.

2. Plates shall be as manufactured by P&S; or Hubbell; or Leviton; or General Electric.

2.07 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 Owner with six screwdrivers for this type.

2.08 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 under-ground pullbox covers and similar electrical items. Galvanizing averages 2.0 ounce per square foot and conforms to ASTM A123.

2.09 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 water-proofing 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.

2.10 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:

Manufacturer	Type
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.

D. Contactors and/or Relays Cabinet

1. Contactors, relays, and/or timeswitches 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, or relay 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.

2.11 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 rain-tight 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.

PART 3 - EXECUTION

3.01 GROUNDING (ADDITIONAL REQUIREMENTS)

A. Grounding shall be executed in accordance with all applicable Codes and Regulations, CEC article 250

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 25 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 outlet 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) ⅝-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.

7 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.

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 occurring 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 DIMMER SWITCHES (ARCHITECTURAL DIMMING)

A. General

1. Do not break off dimmer cooling fins.

2. Dimmers shall be surface or flush wall-mounted at the location indicated on the Drawings.

3. Provide controls and control circuits in conduit connecting between dimmers, controllers and light fixtures, shall comply with respective Manufacturer’s recommendations.

a. The Drawings do not show all of the lighting system point-to-point control circuit connects. Provide conduit and control circuit connects in conduit, all to comply with the Lighting Controls Manufacturer recommendations, include all materials and work as part of the Contract Requirements, for complete and operational lighting controls in each room.

4. Provide outlet boxes for dimmer control stations. Provide equipment cabinets for dimmer equipment at each room location with dimming equipment, flush wall mount unless indicated otherwise on Drawings.

B. Set-up, Testing, and Commissioning

1. Provide set-up, testing, and commissioning of lighting dimming system.

2. Comply with CA-T24 Energy Code for commissioning. Comply with Manufacturer’s set-up and testing recommendations.

3. Set-up and program lighting scene presets, lighting intensities, fade rates, and zone controls. Document and coordinate setup parameters with the Owner’s Representative.

4. Provide factory trained and authorized Technicians to set-up, test and commission the lighting dimming control systems in each room, prior to initial energizing system.

END OF SECTION 26 0501
021323/1126014

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.

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-inches 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.

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 pinholes.

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.

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 CEC 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 lock-nuts).

3) Thomas & Betts-5123 (compression type) Series (with two lock-nuts).

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 FMCs 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

Thomas & Betts- 3110 Series (with locknut)

45- and 90-Degree Angle Connectors

Thomas & Betts-3130 Series (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”.

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-inches 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

a) Thomas & Betts - 5331 GR Series.
b) Appleton-STB Series; STN-L Series for use with preformed “knockouts”.
c) Emerson- OZ/Gedney - 4Q Series.

2) 45- and 90-Degree Angle Connectors

a) Thomas & Betts - 5341GR and 5351GR Series.
b) Appleton-STB-L Series; STN-L Series for use with preformed “knockouts”.
c) 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 Manufacturer’s name.

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.

3. RNMC fittings connecting to metallic raceways shall be provided with a ground/ bond jumper connection.

G. 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 CONDUIT SUPPORTS

A. General

1. Conduit Supports, hangers and fasteners for metal conduit shall be steel, hot dip zinc galvanized.

2. Threaded hardware shall be continuous, free running threads.

3. 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.

4. Provide lock washer at each “bolted”/threaded connection.

5. Conduit supports, fasteners, channels, braces, hardware, anchors, pipe clamps, and hangers as manufactured by Unistrut or Kindorf.

6. Supports shall be free of “BURRS” and sharp edges.

7. 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 “pre-locate” 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.

2.03 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. At the direction of the Owner, aluminum conductors shall not be permitted.

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

d. All other enclosed raceway locations not described above.

1) XHHW-2

2) THWN-2

3) THW-2

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

120/208 Volt

Ground Green
Phase A Black
Phase B Red
Phase C Blue

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.

3. Feeders identified as to phase or leg in each, panelboard 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 California 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 Owner’s Representative in writing for approval prior to installation.

D. Panel and Equipment Feeders

1. Wire size shown on the Drawings is for copper conductors. At the direction of the Owner, aluminum conductors shall not be permitted.

PART 3 - EXECUTION

3.01 TRENCHING, FOOTINGS, SLEEVES

A. Provide trenching, concrete encasement of conduits, back-filling, 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 Owner's Representative. Such permission will not be granted, however, 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 Owner's Representative shall review walls before any work is performed. All sleeving shall be accomplished according to the instructions of the Owner'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. 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.

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 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:

   a.

Feeder, Sub-feeders and Branch Circuit Protection	Minimum Equipment Ground Wire Size
15 amp	#12
20 amp	#12
0 to 60 amp	#10
70 to 100 amp	#8
101 to 200 amp	#6

4. 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.

5. 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.

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.

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 otherwise: 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, pull boxes, 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 two.

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. RMC conduit and RMC fittings may be installed in any location where EMT and FMC conduit is permitted to be installed.

C. 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.

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.

D. 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.

E. 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.

F. 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. RNMC type “EB” conduit(s) shall be concrete encased along the entire length of the conduits for all installation locations.

3. Non-metal type raceways and RNMC type conduit shall not be installed inside buildings.

G. Conduit Installation

1. Conduit Supports

a. Securely and rigidly support all raceways/conduits from the building structure. Raceways/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-inch by means of hanger rods or hanger wires.
b) Conduits 1.5-inch 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.

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.

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 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 Owner'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.

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-inches 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 stubouts from outlet boxes and equipment located in hollow stud walls, into ceiling and floor spaces, shall be EMT or RMC conduit. The stubouts 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. Concrete for encasement of underground conduits shall be 2000-PSI 28-days cure strength with a mix of cement, sand, water and maximum of ¾-inch gravel. Concrete encasement of conduits shall be continuous without voids. The encasement 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.

c. 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.

d. 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 Back-filling 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. Back-filling 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 back-filled 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. Back-filling 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. Back-filling 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 backfilled 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 of aggregate greater than 3-inches.

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 Owner’s Representative has approved Installation and As-Built Drawings are up to date. Promptly install conduits after excavation has been done, 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 underground utility, the conduit may cross above the existing underground utility.

k. Provide long radius horizontal bends (minimum radius of 36-times the conduit diameter) 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-inch. 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. Groundwater shall not be allowed to rise around the pipe until joining compound has firmly set.

2) The Owner'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-pounds 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.

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. 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):

	Conduit Type	Conduit	Fitting Length Spacing
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. Rigid steel conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock absorbing bases.

15. 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.

16. RNMC conduit:

a. Joints and fittings shall be solvent welded to RNMC conduit. Joints and fittings shall be watertight and airtight after fabrication.

17. 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 Owner’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.

G. 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.

H. 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 contact, 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-inches 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 ⅛-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 Owner'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 thru 8986, Plymouth or equal.

H. Neatly group and lace all wiring in panelboards, motor control centers and terminal cabinets with plastic ties at 3-inches on centers. Tag all spare conductors.

3.05 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. Owner'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
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SECTION 26 2416

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, overcurrent 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 Study.

d. CEC

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.

1.03 SEISMIC EARTHQUAKE AND WIND LOADING WITHSTAND, TESTING AND CERTIFICATION. (ADDITIONAL REQUIREMENTS)

A. General

1. The complete panels and terminal cabinets’ 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 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

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

d. ASTM-B187.

2. Where indicated on the Drawings shall be furnished with sub-feed breakers and/or additional conductor lugs, split bussing, contactors, time switches, relays, etc., as required.

a. Branch circuit panels up through forty-two circuits shall be single 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 Owner’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 Manufacturer’s flush locks and keys except where indicated otherwise herein. Keys and locks shall be inter-changeable 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 208/120 volt, three phase, 4-wire, S/N or 120/240-volt, single phase, 3-wire, S/N.

Branch circuit panel as manufactured by:

1. Cutler Hammer “Pow-R-Line 1 or 2” Series

2. General Electric "A" Series

3. Square D “NF/NQ” Series

4. Siemens “P1/P2” Series

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.

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.

F. Panel Auxiliary Cabinets

1. Panelboards shown on the Drawings with relays, time clocks or other control devices shall have a separate auxiliary metal barriered 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 panelboard.

4. Provide mounting subbase in cabinet for control devices and wiring terminal strips.

G. 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.

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.

	C/B and/or Bus Rating	Circuit Voltage	Short Circuit Amp.
1.	400A and less	240V and below	10,000A

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 with-stand 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. 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.

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.

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. Cutler Hammer

   b. General Electric Co.

   c. Square D Co.

   d. Siemens

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. 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.

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 Owner's Representative.

2.04 PANEL BUSSING

A. Bus Material

1. Bussing shall be rectangular cross section tin-plated copper. As directed by Owner, aluminum panel busing shall not be permitted.

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.

2. Provide additional isolated ground bus in each panel with connecting isolated ground feeders and/or connecting isolated ground branch circuits.

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 ⅝-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 ensure 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. Manufacturer shall stencil the panel/cabinet number identification on the inside of door to correspond with the designation on the Drawings.

B. 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
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SECTION 26 2703

DISTRIBUTED COMMUNICATIONS 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.

2. General Provisions and Requirements for electrical work.

B. Principal items of work shall include, but not be limited to the following:

1. Furnishing/installing and connecting to an existing public address/paging system including interior and exterior speakers and control modules as indicated on Drawings.

2. Furnishing and installing all connectors, power supplies, and equipment as may be required, as specified herein.

3. Performing necessary revisions to or furnishing and installing and connecting all wiring and terminal strips, in cabinets and on backboards, necessary to provide for Functions and Requirements specified herein. All conductors or cables shall be installed in conduits or raceways, unless indicated otherwise. Contractor must include all terminations from the field and from the existing equipment headend equipment and all cross-connect wires in his warranty. Contractor is to determine if existing field terminations are warrantable and either replace them or include them in the warranty.

4. Engineering design, testing, materials, components, and supervision necessary to provide a complete operable installation.

1.02 SUBMITTALS

A. Submit product data sheets and descriptive literature for all component parts.

B. Submit block writing diagrams of the public address/paging system.

1.03 QUALITY ASSURANCE

A. Contractor shall warrant and guarantee that all work executed, and materials furnished are free from defects of material and workmanship for a period of 2 years from acceptance date of Contract Completion, not including specific items of work which require a guarantee or warranty of a greater period of item as set forth in the Specifications. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at **no** expense to the District any defective material or work which may be discovered before the final acceptance of work or within guarantee period, any material or work damaged thereby, and all adjacent material or work which may be displaced in repair or replacement required

hereunder. Examination of failure to examine work by the District shall not relieve Contractor from these obligations.

B. If the Contractor fails to repair or replace material or work as indicated above within 24 hours of receiving a written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess the cost thereof against Contractor when necessary for keeping school open or safety operating if the Contractor does not respond accordingly.

C. Ordinances and Regulations:

1. All work of this Section shall conform to California Building Code and California Electrical Code.

D. Permits and Inspections: Obtain and pay for permits and inspections required and deliver certificates of inspection to the District Inspector.

E. All work shall be done by a qualified Contractor holding all the licenses required by the legally constituted Authorities having jurisdiction over the work. Contractor shall have completed at least three projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years. Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair serve to the equipment.

F. Installation shall be carried out under direction of a qualified Engineer at the Contractor's expense.

1.04 QUALIFICATION OF BIDDERS

To qualify as an acceptable Bidder, whether the bid is submitted to the District, his Agent, a General Contractors, or a Sub-Contractor shall be qualified Sound Contractor and shall hold a valid C61 License issue by the Contractors State License Board of California. 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 Contactor shall be the Factory-Authorized Distributor for the brand of equipment offered and shall have been engaged on 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.

1.05 EQUIPMENT QUALIFICATIONS

A. All equipment shall be exclusively as produced by the Manufacturers' names herein and on the Drawings to match existing equipment on the site and operational and maintenance systems within the District. No substitutions or equals will be approved.

B. All 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.

PART 2 - PRODUCTS

2.01 MATERIALS

Comply with pertinent provisions of Section 26 0500.

2.02 EXISTING CAMPUS CENTRAL EQUIPMENT

A. Visit site and become thoroughly familiar with existing public address/paging system equipment prior to submitting a bid. Include within this Contract all costs to modify and/or add to the existing central equipment as required to fully serve the new construction.

B. Provide auxiliary components and/or accessories where required to interface new and existing equipment.

C. Provide all system programming including the necessary product handlers so that all perimeters are entered into the system and annunciator displays text, which is customized to the facility.

2.03 PUBLIC ADDRESS/PAGING SYSTEM

A. The existing Bogen Model TPU100B public address/paging system on campus shall be expanded as required to serve the new construction. Provide final connections to equipment rack and for re-programming of the system to account for the new construction.

1. Speakers

a. Interior speakers shall be 8-inch diameter paper cone type with T25 25V line matching transformer. Frequency range to be 30Hz to 15,000Hz. Interior wall-mounted speakers shall be mounted in Soundolier #198-8/ 161 backbox/baffle to match existing on site.

b. Exterior speakers shall consist of an Atlas #AAPF-15 Series loudspeaker with T-11 transformer in Soundolier #L20-211/VP161-APF backbox and cover to match existing on equipment. Housing shall include a baffle and shall be painted to match surrounding surfaces.

3. Cabling

a. Cable run in conduits below grade shall be Teflon-coated or otherwise approved by the Manufacturer for the purpose. Repull any existing site runs and add conductors necessary to add new cabling and return existing rooms to operation.

b. Cable serving exterior speakers shall be a twisted pair of #14 AWG solid copper conductors with overall and jacket. Each speaker shall have separate conductors' homerun back to termination location as indicated on Plans.

c. Cable serving interior speakers shall be a twisted pair of #16 AWG conductors with overall shield and jacket. Each speaker shall have separate conductors' homerun back to termination location as indicated on Plans.

d. All cabling shall be of the type approved or the areas where it is used.

PART 3 - EXECUTION

3.01 MATERIALS

Comply with pertinent provisions of Section 26 0500.

3.02 WIRING DESIGNATION AND TERMINAL CABINET MAKE UP

A. All #22AWG and #24AWG connections throughout the system shall be made by spring tension clip "punch block" Siemens Type 66 terminals or equal. Wires of #16 gauge and larger shall be terminated on barrier screw terminals. All conductors in terminal cabinets shall be carefully formed and harnessed in a workmanlike manner.

B. All wiring for complete communications system shall be new wire. Multi-pair cables may be used between buildings. Any wires pulled through in ground junction boxes shall be continuous with no splices. The wiring shall be intact with no cuts in the protective outer jacket. All splices to be made in above ground junction boxes, using terminal strips in all cases.

C. Provide all cabling from building terminal cabinets to each outlet shown on the Plans.

D. Provide labeling for each conductor with identification as its use and function as per District Requirements.

3.03 PORTIONS OF CABLES

A. The portions of cables installed without raceways or cable tray supports shall be installed with “j-hook” cable supports.

B. The “j-hooks” shall provide multi-tiered “treed” “J” shaped hoods, with wide flat cable support base (0.5-inch wide minimum) and smooth rounded corners, specifically designed for Category-5 and fiber optic cable support. As manufactured by Erico Inc.

C. The individual “j-hook” attachment to the building structure shall be “beam clamp”, “hanger rod”, clevis hanger styles.

D. Install “j-hooks” not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to “j-hooks” with cable tie wraps. “J-hook” supported cables, bundle cables together with tie wraps.

E. “Bridle rings” shall not be used to support cables.

F. Cables shall not lay directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

3.04 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.

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 impedances 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 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. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

G. 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.

3.05 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.

3.06 EXISTING CONDUITS

A. Include within this Contract sufficient labor costs to locate, trace, and verify existing conduits related to the new construction. Examine each site including terminal cabinets, panels and ceiling spaces in order to identify existing conduits and Plan Layout of new conduits.

B. Notify the Architect immediately if existing conduits are discovered to be broken or in any other way not usable as specified.

C. All new wiring shall be installed in conduit, unless noted otherwise.

END OF SECTION 26 2703
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SECTION 26 5005

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 Ballasts and power supplies, (or alternately, Manufacturer's published catalog data) stating/showing the specific lamp, ballast, or power supply combination comply with Manufacturer recommendation and approval for the combined use, shown on the Drawings.

2. Provide complete Manufacturer’s catalog data information for each light fixture (luminaire), ballast, lamp, materials, auxiliary equipment/devices, finishes and photometrics.

B. Performance Certification

1. Submit Manufacturers certified lamp and ballast tests 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 assemblies are 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 Owner'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 Owner'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 Owner's Representative. Decision of Owner'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 – 1572: HID Lighting Fixtures

   b. UL – 1570: Fluorescent Lighting Fixtures

   c. UL – 1029: HID Ballast

   d. UL – 935: Fluorescent Lamp Ballast

   e. UL – 542: Lamp Holders, Starters, and Starter Holders

   f. UL – 8750 and 1598C: Light Emitting Diode – LED Equipment for use in Lighting Products and replacements

2. NEMA – National Electrical Manufactures Association:

   a. NEMA – LE4: Recessed Luminaries 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 Recommended Practice for and IESNA 500: installing Indoor Commercial Lighting Systems.

   b. NEIS/NECARecommended Practice for and IESNA 501: 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: Transient 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

Lamps and lamp ballasts 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 POWER SUPPLIES

(For Driver-Power Supplies for LED-Solid State Lamps)

A. General

1. All power supplies, lighting fixtures assemblies and components shall be ANSI, ETL approved C.B.M. certified and UL labeled.

2. Lamp ballasts, power supplies and transformers shall be for use with the specific lamps provided as part of the Contract.

3. 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.

4. Fusing

   a. Shall be independently fused on the incoming line side within the fixture compartment.

   b. Alternately the Manufacturer may install the equipment fuse inside the 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 Owner’s Representative.

5. Electronic solid-state power supplies shall be the product of Manufacturer that has been producing power supplies for a minimum of 5-consecutive years prior to the date of the Contract.

6. 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 minus 20-degrees below zero Fahrenheit.

7. Shall be designed and supplied to operate on the incoming line voltage system circuits to which the respective light fixtures are connected.

8. 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%.

9. Power Supplies Disconnect:

   a. Lighting Fixture Manufacturer factory installed and prewired inside each light fixture, for lamp-driver power supply.

b. Shall comply with UL-2459 and CEC. Shall disconnect (load-break) energized or de-energized 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-power supplies.

10. Power supplies as manufactured by General Electric, Advance, Philips, Universal, Sylvania/Osram or equal.

B. Emergency Lighting

1. Light fixtures shown connected to both normal power and external emergency power branch circuits, shall be furnished with power supply for the normal and emergency power circuits.

2.03 LIGHT FIXTURES (LUMINAIRES)

A. General

1. Lighting fixtures shall have all parts, power supplies, 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 LED’s and lumen rating as 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 Owner'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 16 AWG "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. Lighting fixtures installed in masonry and/or concrete construction. The fixture housing shall be rated for "concrete-pour" installation location.

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 LED lamps and associated operating and starting equipment. Provide ballasts/transformers inside lighting fixture that is, connected to a multi-lamp ballast in another luminaire.

2. Wire insulation for ballast/lamps employing igniters, shall be rated and UL listed for the igniter pulse voltage.

3. Light fixture internal LED lamps and power supply; grounding of lamps and power supplies; and wiring connections, shall all comply with the recommendations of Ballast Manufacturer and Lighting Control System Manufacturer.

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.

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 (± 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.

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 Owner'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 Owner'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.

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. 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.

3. 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. 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 LED lamps.

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 Owner.

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 Owner’s Representative.

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 5005
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SECTION 27 4200

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.

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 Intercom Voice Communications.

3. Closed-circuit surveillance cameras.

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/VISTA or Version-7 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, and 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 fifty complete channel/circuit paths. The calculations shall include attenuation insertion loses 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.

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/EJA-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. 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:

1. IEEE 802.3/ETHERNET latest revisions:

a. 10Mbps 10Base-T, 100Mbps 100Base-Tx, and 1000Mbps (1Gbps) 1000 Base-Tx for copper wire; 100-meter communications pathway distance.

b. 10Mbps 10Base-F1, 100Mbps 100Base-FX, 1000Mbps 1000Base-Lx-Sx and 10,000 Mbps (10Gbps) for fiber optics; 550-meter communications pathway distance, OM4 Standard.

c. IEEE-802.3 for Power Over Ethernet (POE) and Power Over Ethernet-Plus (POE Plus).

2. FDDI - Distributed data interface on fiber or copper wire, 100Mbps.

3. 100VG – Any LAN

4. TIA/EIA Serial and Bi-directional RS-232 and RS-485, including Star-Hub repeaters.

5. 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:

Belden – 10GX Series; or CommScope-Systimax X10D Series:
or AMP/Tyco – NetConnect Series.
or Ortronics/Legrand – NetClear Series.

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 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-compiling 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 20-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

Abbreviation	Terminology
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 workstations 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 = $l0^{-3}$ 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.
um	Micrometer = 10^{-6} meter.
USE	Universal Splice Enclosure.
UTP	Unshielded twisted pairs copper wire.
VoIP	Voice communications Over Internet Protocol.
WGNA	WideBand Gigabit Networking Alliance.
Workstation or Workstation location	Spaces remote from the MDF/IDF terminal 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. Computer/data network systems: Category-6.

b. Telephone/intercom voice systems: Category-6.

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 FIBER OPTICS CABLES

A. General

1. Operating temperature range -20 degrees centigrade through +60 degrees centigrade. Cables shall be flame-retarding.

2. 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, fiber optic “FHC-25/50-CMP and/or OFNP/OFCP”.

   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 rooms.

   f. NFPA-13; spaces containing “limited combustible loading”.

3. Cables shall qualify as 100% recyclable materials disposal, RoHS Regulation complaint.

4. 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.

5. Cables shall be UL listed, complying with California Electrical Code, ETL Tested and certified to comply with Specified Requirements. ANSI/TIA/EIA-568C including related Standards, Amendments, and TSB.

6. 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.

7. Fiber optic cable shall be a product of the same Manufacturer, including portable patch cables.

8. Cables installed in raceways or conduits below grade, through in-grade manholes or pullboxes shall be rated for installation in water/wet locations.

9. 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).

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.

11. 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 wavelengths.

    b. Maximum attenuation:

@ 1310nm- wavelength	0.5 dB @ 1km length
@ 1550nm- wavelength	0.4 dB @ 1km length

    c. Maximum dispersion

@ 1310nm- wavelength	2.8 ps/nm km length
@ 1550nm- wavelength	18.0 ps/nm km length

    d. Laser-optimized "OS1"/OS2" optical single 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, 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, 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 CEC and NFPA Requirements for each installation location shown in the Contract Documents. ETL tested and certified to comply with or exceed Specified Requirements.

   a. CEC - 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. CEC - 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 CEC and NFPA Requirements for each installation location shown in the Contract Documents. ETL tested and certified to comply with or exceed Specified Requirements.

   a. CEC - OFNP (UL FHC-25/50 LC Plenum type locations and locations where not continuously enclosed inside conduits for entire cable length).

2.02 COPPER WIRE CABLES (TWISTED PAIRS)

A. General

1. Conductors shall be copper wire, individually insulated and color-coded, with multiple conductors arrange 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 CEC California 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. CEC MPP/CMP, FHC-25/50 (plenum type locations and locations where not continuously enclosed inside conduit).

   b. CEC 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 rooms.

   f. NFPA-13; spaces containing “limited combustible loading”.

5. Cables shall qualify as 100% recyclable materials disposal, RoHS Regulation complaints.

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.

7. The outer cable jacket shall be imprinted with date, Manufacturer's model and catalog number and agency (AHJ) listing identification.

8. Cables installed in raceways or conduits below grade, through in-grade manholes and pullboxes shall be rated for installation in water/wet locations.

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. Voice trunking cables: Copper wire cables with more than twenty-five twisted pairs of conductors shall be constructed with twenty-five 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. Voice trunking cables shall be Catergory-5E.

B. Category-6 Computer/Data Cables – UTP

1. Category-6 cables shall be tested and shall pass the ANSI/TIA/EIA test recommendations for Category-6.

2. Operation Characteristics:

a.	Wire size	23AWG solid copper (23AWG 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 ± 15%, 1-250MHz
d.	Maximum Signal Attenuation Per 328-feet (100 meters).	2.0dB @ 1MHz 3.8dB @ 4MHz

5.3dB @ 8MHz
6.0dB @ 10MHz
7.6dB @ 16MHz
8.5dB @ 20MHz
9.5dB @ 25MHz
10.7dB @ 31.25MHz
15.4dB @ 62.5MHz
19.8dB @ 100MHz
29.0dB @ 200MHz
32.8dB @ 250MHz

e. Mutual Maximum Capacitance of Any Pair 5.0nF/100m

f. Worst Pair "NEXT" Loss per 328-feet (100 meters)
74.3dB @ 1MHz
65.3dB @ 4MHz
60.8dB @ 8MHz
59.3dB @ 10MHz
56.2dB @ 16MHz
54.8dB @ 20MHz
53.3dB @ 25MHz
51.9dB @ 31.25MHz
47.4dB @ 62.5MHz
44.3dB @ 100MHz
39.8dB @ 200MHz
38.3dB @ 250MHz

2.03 FIBER OPTIC FIBER SPLICES

A. General

1. Fiber optic cable splices shall be UL listed, complying with California 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 wavelengths.

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 wavelengths.

2.04 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 California 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 Intermate-ability 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 dust cover cap for each connector.

c. Locking type to automatically align mating fibers in the fiber cable and prevent accidental rotation and pullout.

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.

2.05 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 California 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 pairs of 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 outlet.

d. Inserts for different infrastructures shall be color coded with different colors from each other, for system identifications.

e. Plug-in adapters 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.

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-inches including Premise Wiring Termination Depth Requirements.

2.06 FIBER OPTIC FIBER DISTRIBUTION ENCLOSURES

A. General

1. Fiber optic fiber distribution enclosures shall be UL listed, complying with California 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.

B. Equipment Rack Mount Fiber Optic Termination Distribution Enclosure - RTDE

1. The RTDE enclosure shall mount in an EIA Standard 19-inches 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 "pigtail" 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 (twenty-four 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:

Quantity of Patch Ports	Quantity of Splice Drawers	Nominal Height
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-inches 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:

Quantity of Thru Splices	Quantity of Splice Drawers	Nominal Height
24	2	4 inches
48	2	4 inches
72	4	8 inches
96	4	8 inches

2.07 COPPER WIRE PATCH PANELS

A. General

1. Copper wire patch panels shall be UL listed, complying with California 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-inches wide metal panel, Manufacturers standard color. Prepunched for copper wire outlet connectors. Panel shall mount on an EIA standard 19 inches wide enclosed or open frame equipment rack assembly. Nominal twenty-four 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:

Outlet Quantity	Nominal Patch Panel Height
1-24	3.5 inches
25-48	7 inches

49-72	14 inches
73-96	21 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.

2.08 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-#4 AWG.

2. Vertically mounted, cable management enclosed metal channels (aluminum or stainless steel) shall be provided full height, continuously along the side of each vertical rail of the equipment rack. The channels shall be bolted to the equipment rack. The channels shall train, and dress vertically routed portable patch cords connecting between outlet connectors located in the equipment rack or in adjacent equipment racks. Vertical metal channel nominal size 6-inches by 6-inches square with removable access covers.

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-inch high by 3-inches deep and/or (for up to forty-eight 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 “Velcor” 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 48 or less copper wire outlets for patch ports.

   b. One cable management panel (front and rear of rack) for each group of 48-fiber optic outlet patch ports.

4. The entire rack assembly including any support arms shall comply with seismic install location Earthquake 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 safety factor shall be included in the equipment rack assembly structural design.

b. Mini-equipment racks shall be rated for not less than 200-pounds of equipment. Plus, a 2.0 times safety factor shall be included in the mini-equipment rack assembly.

5. Provide Surge Protection Device with RF Suppresser (SPD) and Power Distribution Unit (PDU). 120-volt, 1 phase, 20-amp 60Hz AC plug horizontal strip, mounted in each equipment rack. Each unit shall contain not less than six “plug-ins” on the rear of the SPD and not less than two plug-ins 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-inches (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, 12-AWG three conductor grounded, high abuse heavy duty jacketed AC, line cord with NEMA 5 20P cap. 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.

b. Protected 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.

c. 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.

d. Non-blocking plug-in locations/orientation, for plug-in self-contained "power-brick", equipment power supplies.

e. 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. Transient 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 the same Performance Requirements including as follows.

1) EIA/TIA – Equipment racks horizontal mount style (19-inches or 24-inches as applicable).

2) Minimum of two front mounted outlets and not less than six rear mounted out-lets.

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 electrical 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 1-phase 4-wire grounded 60Hz AC and as indicated on Drawings.

b. Branch load circuit breakers with a single plug-in receptacle 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.

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. PDU units shall be installed in equipment racks and shall comply with all 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.

5. Provide two Category-6 4-pair UTP 15-foot-long portable patch cable connects, PDU to respective network patch panel port.

2.09 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-lock-able. 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 California 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.

2.10 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 water-tight integrity of the enclosure.

4. The universal splice enclosure assembly shall be UL listed.

5. The USE shall be UL listed, complying with California 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 twelve 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.

2.11 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 California 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.

2.12 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 California 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 work-station 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. 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 out-let cable connections.

2. Wall mounted

a. Flush or surface and size wall mounted outlet box as indicated on the Drawings, but in no case less than 4.69-inches by 4.69-inches by 2.125-inches deep.

b. One or two gang wide extension ring for outlet box to extend outlet flush with finish surface, or as noted on the Drawings.

c. One or two gang wide cover plate, or as noted on the Drawings.

3. 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.

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.

2.13 PORTABLE PATCH CORDS

A. General

1. Provide portable patch cords for all copper wire and fiber optic cable infrastructure outlets:

   a. For interconnecting electronic network equipment to electronic network work-station 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 California Electrical Code, ETL Tested and certified to comply with or exceed Specified Requirements. ANSI/EIA/ T1A 568C related Standards, Addendums and TSB.

   a. CEC - OFNG/OFN for fiber optic portable patch cords.

   b. CEC - MPP/CMP/CMR/CMG/MPG for copper wire twisted pair portable patch cords.

4. Patch cords which are not installed shall be delivered to the Owner in cardboard 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 or ScTP 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/with drawl 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 yellow.

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 work-stations 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 black.

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 HUBs, 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 Manufacturer 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. 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 “duplex” with two fiber strands 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 Manufacturer's standard color, except black or yellow jacket color shall be unacceptable.

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 workstation 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.

3. Single mode patch cords:

a. Patch cord cable shall be fiber optic cable with single mode optical glass fibers, and with equal or better characteristics as the premise fiber optic cables.

2.14 CIRCUIT PROTECTORS

A. General

1. The circuit protectors shall be UL listed, complying with California 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 out-lets 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 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. 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 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 expenses.

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. 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 wavelengths, 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 inner-duct.

b. Inner-duct shall be heavy duty, plenum-rated, Limited-Combustible (LC) type UL FHC – 25/ 50, orange color. Support inner-duct 36-inches on center, independent of ceiling supports and independent of other equipment supports.

c. Inner-duct size shall be selected to insure percentage-fill with fiber optic cables shall not exceed 30%, but in no case less than 1.25-inch diameter inner-duct.

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, multi-mode and twelve optical fibers, single mode.

3. 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-6, UTP 4-pair cable:

    a. Each network workstation outlet location.

    b. Each network "wireless-access-point" outlet location.

2. One Category-6 UTP 4-pair cable, for each telephone handset (instrument) workstation outlet location.

3. Three Category-6 UTP 4-pair cable, from each of the teacher's computer workstation outlet device location.

4. One Category-6 UTP 4-pair cable, for each projector outlet location.

5. One Category-6 UTP 4-pair cable, for each surveillance camera outlet location.

6. 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.

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 backboard. 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-enterable 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 un-terminated 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 "tye" 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 Colliod 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.

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.

Cable Type	Cable Fiber Quantity	Min. Bend Radius	Max. Pulling Tension
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 ten 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 "crossovers".

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 insure 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 multitiered “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 twelve 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:

	Equipment Type	Minimum Separation
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 times 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 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-inch 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-cable 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 #l 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 insure 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 inches at any location and the cable jacket shall not be striped back not more than 0.5 inches 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 hardware. "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 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:

    a. 100% copper wire outlet connectors, 196-maximum per rack. Forty-eight maximum in 30-inch high and 96-maximum in 48-inches high mini-equipment racks.

    b. 100% fiber optic fiber terminations, 144-maximum per rack 24-maximum in mini-equipment racks.

    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. Twelve maximum fiber plus 48-maximum copper wire in 30-inches high and 24-maximum fiber plus 48-maximum copper in 48-inches high mini-equipment racks.

    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 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. Securely anchor the support arms of swing gate racks to the wall structural support system.

   b. 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.

   c. Attachments and anchorage shall comply with the Requirements for Earthquake Seismic Zone.

10. Install ground bus, PDU/SPD, cable management rings, equipment, patch panel, and patch panel outlets, etc. in equipment racks.

11. 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. An 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. Mini-Equipment Racks:

1. Install surface mount on the wall, on wall mount horizontal “C” channels.

2. Bottom of the rack shall not be less than 6-feet – 6-inches above finish floor. Top of rack tight to ceiling.

3. Position the rack to allow the door section, and center section to swing open a full 90 degrees Arc without obstructions.

4. Connect raceways to the non-moveable pan section.

3.08 GROUND (ADDITIONAL REQUIREMENTS)

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.

3.09 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.

2. Infrastructure documentation, identification labels and color coding shall comply with ANSI/TIA/EIA-606A Administration Standard for Telecommunications Infrastructures, Class-1 through 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; #24 AWG 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-inches 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 #14 AWG (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 Contractor's 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 ⅛-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 4200
021323/1126014

SECTION 28 3100

INTRUSION DETECTION

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.

B. Principal items of work shall include, but not be limited to the following:

1. Furnishing/installing and connecting to an existing intrusion detection system including motion sensors, door contacts, keypad and clocks as indicated on Drawings.

2. Furnishing and installing all connectors, power supplies, and equipment as may be required, as specified herein.

3. Performing necessary revisions to or furnishing and installing and connecting all wiring and terminal strips, in cabinets and on backboards, necessary to provide for Functions and Requirements specified herein. All conductors or cables shall be installed in conduits or raceways, unless indicated otherwise. Contractor must include all terminations from the field and from the existing equipment headend equipment and all cross-connect wires in his warranty. Contractor is to determine if existing field terminations are warrantable and either replace them or include them in the warranty.

4. Engineering design, testing, materials, components, and supervision necessary to provide a complete operable installation.

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 exclusively as manufactured by Bosch to match existing system on site as well as existing Maintenance and Programming Requirements in the District. No substitutions will be approved. Call 1-800-289-0096 for a list of local factory-authorized suppliers.

C. The system shall be serviced by a field supported 2-year warranty.

D. All equipment shall conform to all local applicable Codes and Ordinances and shall be listed by Underwriters Laboratories.

E. 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 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-compiling 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 terminal cabinet, keypad, and conduits as indicated on plans.

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 each exterior door of the building. Connect respective door contacts in the system to initiate a timing circuit for keypad operation.

D. Provide magnetic switches at each roof hatch.

E. Provide all conduits, cabling, and outlet boxes required for a complete and operable system.

1.04 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets for all switches, keypads, wiring devices, device plates, controllers, power supplies, cabinets, etc.

B. 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.

PART 2 - PRODUCTS

2.01 MATERIALS

Comply with pertinent provisions of Section 26 0501.

2.02 EXISTING CAMPUS CENTRAL EQUIPMENT

A. Visit site and become thoroughly familiar with existing intrusion detection system equipment prior to submitting a bid. Include within this Contract all costs to modify and/or add to the existing central equipment as required to fully serve the new construction.

B. Provide auxiliary components and/or accessories where required to interface new and existing equipment.

2.03 SYSTEM FUNCTIONS

A. Provide a complete and operable supervised intrusion detection system as shown on the plans including but not limited to keypad stations, motion detectors and connections to door switches.

B. Upon detection of an intruder by initiation of any device in the system, the system shall cause the annunciator LED to light. Alarm information shall be sent by an existing digital dialer over the telephone lines to receiver located at District's maintenance shop.

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. The gymnasium 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.

2.04 INTRUSION DETECTION SYSTEM

A. Provide additions to existing campus DSC (Digital Security Controls) Power 832 intrusion detection system control panel and re-program as required to account for the new devices.

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. Provide all necessary hardware, wiring and connections for a complete and fully operable system.

2.05 KEYPADS

Sub-zone keypads shall be DCS to match existing on site. Keypad shall be surface wall mounted in lockable NEMA-3R enclosure on building exterior as shown on Drawings.

2.06 MOTION SENSORS

Motion sensors shall be Detection Systems Inc. DS774 Series for wall mounted types and DS938 for ceiling mounted types to match existing on site. 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.

2.07 MAGNETIC SWITCH

Magnetic switch shall be fully concealed in the door frame, Admeco, Sentrol or equal.

2.08 INTRUSION DETECTION SYSTEM TERMINAL CABINET

Each intrusion detection system terminal cabinet shall contain a 12-volt DC power supply with a minimum 7-amp hour battery backup for motion sensors and POPEX (Zonex) modules. All popits and detectors shall be clearly marked on the exterior with its own address. All motion detectors shall have their own unique address. All popits for the cafeteria building shall be centrally located in or near the terminal cabinet and/or control panel and secured to ¾-inch thick marine “A-C” grade plywood backboards. A side of plywood shall be exposed and pained. Attach plywood to wall structural framing with mechanical fasteners a minimum of 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. Backboard shall be of sufficient size to accommodate all popits and provide an additional 20% for future expansion.

2.07 CABLING

Cabling shall be Westpenn 369 or equal as required for system operation. All cabling shall be shielded.

PART 3 - EXECUTION

3.01 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

The outside cover of motion sensor devices shall be marked with the typed unique address initiating number corresponding to the address number in the control panel. Marking shall be with a felt-tip pen.

3.02 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 make 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 and backboards shall be carefully formed and harnessed in a workmanlike manner.

3.03 THE PORTIONS OF CABLES INSTALLED WITHOUT RACEWAYS OR CABLE TRAY SUPPORTS SHALL BE INSTALLED WITH “J-HOOK” CABLE SUPPORTS.

A. The “j-hooks” shall provide multitiered “treed” “J” shaped hoods, with wide flat cable support base (0.5-inch-wide minimum) and smooth rounded corners, specifically designed for Category-5 and fiber optic cable support. As manufactured by Erico Inc.

B. The individual “j-hook” attachment to the building structure shall be “beam clamp”, “hanger rod”, clevis hanger styles.

C. Install “j-hooks” not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to “j-hooks” with cable tie wraps. “J-hook” supported cables, bundle cables together with tie wraps.

D. “Bridle rings” shall not be used to support cables.

E. Cables shall not lay directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

3.04 MOTION SENSORS TO PROVIDE OPTIMUM COVERAGE OF THE SPACE

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.

3.05 DOOR SWITCH INSTALLATIONS

Coordinate concealed door switch installations with Finish Hardware Manufacturer.

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 in the cafeteria 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 PROGRAMMING

All programming shall be as directed by the District.

3.08 TECHNICAL SUPPORT, MANUALS, SOFTWARE AND TRAINING

District Maintenance Personnel shall be provided with continuous technical support, manuals, software, and hardware packages for the intrusion detection system. The

Manufacturer or Installing Contractor must provide complete software and technical manuals. All training or factory certification required of Maintenance Personnel to maintain system will be at the expense of the Installing Contractor. Certification and training shall be for two persons, including transportation and housing, at factory training facility, and shall provide Maintenance Personnel with capability to perform all future programming changes and additions or deletions to the system.

END OF SECTION 28 3100
021323/1126014

SECTION 28 4620

FIRE ALARM 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 this Section.

2. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submittal Documentation

1. See DSA Guidelines #GL-2 for complete submittal.

2. Submit State Fire Marshal, AHJ and UL Listing numbers for each item of fire alarm system equipment and components.

3. 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.

4. A listing of outlet rough-in needed 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 of facilitate locating the data by Field Personnel.

5. Battery and voltage drop calculations on the plans for each panel.

1.03 EQUIPMENT QUALIFICATIONS

A. General

1. The fire alarm system in the Contract Documents has been submitted for review, has been approved with “approval stamped” by the Fire Marshal of Record (AHJ) based on the Manufacturer’s products and listing numbers described in the Contract Documents.

2. The fire alarm system equipment shall be limited to the products of Silent Knight/ Honeywell to match existing equipment on site.

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 Contractor’s 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 the 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.

B. 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. 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.

5. Monitor the standby batteries and, upon a low battery condition or battery charging failure, activate the low battery display and indicate a trouble condition.

6. System ground detection shall be provided for the entire system. Upon ground detection, activate the ground detection display and indicate a trouble condition.

7. 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)

A. Modify and upgrade the existing Notifier NFS2-3030 FACP and Notifier NFS2-640 Voice Evacuation Panel to fully interface with the new construction.

B. Power Supply

1. The power supplies for the fire alarm system shall be adequately sized to properly operate the fire alarm system equipment, including remotely connected, spare and future indicated equipment with all alarm devices in alarm condition. Provide 30% spare power supply capacity for future expansion. Provide transfer modules and multiple power supplies as required for proper operation. Power supplies shall be in integral part of the equipment housings.

2. Input voltage 120/240 volt or 120/208-volt 60Hz AC.

3. Lightning protection, surge transient voltage and RF noise filtering protection on each 60Hz AC input and output phases of the power supply shall be provided.

4. Supervised voltage types (i.e., 120V-60Hz AC, 24-volt AC, 24-volt D.C., etc.) required by special connected equipment shall be supplied to evacuation alarm devices.

5. Battery Back-Up Operation

a. Internal batteries and battery power supplies shall provide 72-hours continuous automatic normal operation of the entire fire alarm control panel and fire alarm systems connected to the fire alarm control panel after the failure of the incoming utility power. Sufficient battery capacity shall remain at the end of 72-hour period to provide 15-minutes of “alarm mode” continuous operation of all connected evacuation alarm devices both visual and audible types.

b. Batteries shall be sealed lead-acid. Batteries shall be earthquake restrained. Batteries shall include catalytic conversion of out-gassing hydrogen gasses.

c. The battery charger shall be automatic, dual rate with capacity to recharge completely discharged batteries in not less than 18-hours. Charger shall be temperature compensated.

2.03 VOICE COMMUNICATION FIRE EVACUATION ALARM

A. General

1. Provide integrated audio/visual fire alarm one way voice evacuation, in combination with audible tone, alert/evacuation, and one way voice / communications system through evacuation speakers, and visual evacuation strobes. The system shall operate not less than four simultaneous independent voice channels, Evacuation, Alert and Auxiliary channels. Provide both local from the fire alarm control panel and distributed amplification remote from the fire alarm control panel, to optimize system performance. The entire voice systems and audio/visual circuits shall be supervised by the fire alarm control panel. The system shall provide zoned audio/visual fire evacuation alarm signaling.

2. The audio sound fire alarm evacuation system shall provide a sound intensity of not less than 15dBA above average ambient sound intensities, and 10dBA 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.

3. Voice Systems Sound Intensity and Intelligibility.

a. Voice systems shall be audible, clear of distortion and intelligible, as defined in NFPA-72, IEC 60849 and 60268 and ANSI S3.2.

b. The audio voice system shall provide a Common Intelligibility Scope (CIS) of not less than 0.8, or Score Speech Transmission Index (STI) of not less than 0.7 STI, average in normally occupied building spaces.

c. The Contractor shall provide additional work and materials to comply with these Requirements including but not limited to:

1) Adjustment of system volumes and adjustment of audio-frequency audio frequency equalization.

2) Adjustment location of speakers and respective circuits.

3) Provide additional audio preamplifiers, audio amplifiers, additional speakers and additional speaker circuits.

d. The additional work and material shall be included in the Contractor's Scope of Work Contract-price. Shall be shown on submittal information.

B. Preamplifiers and Amplifiers

1. Voice system preamplifiers and amplifiers shall be solid state continuous duty:

a. Electronic amplification for audio alarm evacuation speaker circuits.

b. All amplifiers and preamplifiers shall be identical, respectively interchangeable and of the same Manufacturer as the fire alarm control panel.

c. Auxiliary output rated at 4-amp 24-volt D.C. for operation of visual signaling evacuation alarm devices.

d. Quantity of amplifiers and preamplifiers shall be sufficient to supply not less than a continuous 2-watts audio signal to each and every audio speaker connected to the fire alarm system, but in no case less than required for specified sound intensities plus specified spare capacity for future expansion.

e. The voice evacuation amplifiers shall operate in a "sleep" mode to reduce electric energy consumption and automatically return to full rated output during a fire evacuation alarm condition.

2. Amplifier spare capacity. Each preamplifier and amplifier shall be loaded to not more than 70% of specified output capacity, to allow for future expansion and possible changes in speaker watt "tap" settings.

3. Pre-amplifier shall provide audio master control for all voice evacuation related functions. Automatic gain control to provide low distortion voice announcements and tone generator evacuation signals. The quantity and output of the preamplifier shall be sufficient to drive all audio amplifiers to specified maximum output with not more than 5% total system "end-to-end" (including speakers) audio distortion in the described voice frequency range. The preamplifier shall provide individual separate source pre-amplification, volume controls, and tone controls for each separate input source including Fire Fighter's microphones, tone generators, prerecorded voice messages etc.

4. Continuous Duty Operating Characteristics Requirements without any derating or loss of specified characteristics:

a. Amplifier Nominal Operating Output Volt-RMS: 25 or 70

b. Amplifier Minimum Continuous Audio Output at Specified Frequency Response Range: 100 Watts

c. Preamplifier/Amplifier Combined Frequency Response Range at ±1dB: 300Hz to 5000Hz.

d. Preamplifier/Amplifier Combined Maximum Specified Output and Audio Distortion at Frequency Response Range: 1%

e. Audio Hum and Noise Preamplifier and Amplifier Combined: 90dB below rated output

f. Regulation Full load to No Load: 2dB or Better

5. Provide one spare backup identical equipment units for voice system amplifier, pre-amplifier and tone generator. The backup units shall automatically be “switched-into" operation to replace any non-operating unit in the event of a failure or supervisory trouble of any of the respective primary units. The failed unit shall be automatically disconnected and isolated from the fire alarm system, with trouble display at the fire alarm control panel.

C. Tone Generator

1. Shall provide alert and evacuation signal audio tones. The generated tones shall be selectable by the fire alarm system software program control functions as follows:

a. Slow Whoop (ascending or descending audio frequency).

b. “900Hz tone” steady and/or “chime” providing selection of the following tone/chime characteristics:

Steady; pulsed at 122PPM; pulsed at 30 PPM; Coded; Temporal Coded 3; State of California Code; Zone Code; or 4-4-4.

c. Hi/Lo alternating tone frequency.

d. Siren variable wail.

e. 520Hz square wave

2. The tone shall automatically precede prerecorded voice messages and shall be manually controllable by Fire Fighter’s override from the fire alarm control panel.

D. Pre-recorded Voice Evacuation

1. Provide digital processing/conversion storage of prerecorded voice recording and storage of evacuation messages, minimum 15-minutes of messages. The prerecorded voice evacuation system shall also include the desired tone generator signal alert/evacuation with ten tones, in combination with the voice announcements. The prerecorded information “playback” shall be selectable in any combination or individual sequence by the fire alarm system software program control functions, for each zone and by Fire Fighter’s manual override controls. The messages shall be stored in non-volatile memory to prevent the loss of the messages as a result of power failure.

2. The Fire Fighter’s voice microphone module shall provide recording input for storage of voice evacuation announcements.

3. Provide an additional input port for a portable device to download pre-recorded evacuation announcements into the system.

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 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.

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 without 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 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.

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-inches 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-inches 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 10dBa 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. Voice speakers:

a. Fire retardant, moisture/humidity resistant construction for both audible voice and tone notification of fire evacuation alarms, UL-1480 listed.

b Continuous Duty Operating Characteristics Requirements without any derating of the complete speaker assembly or loss of specified characteristics including input transformer:

1) Nominal diameter: 8-inch by 5-inch deep

2) Temperature (Centigrade) range: minus 30 degrees to plus 65 degrees

3) Nominal operating volt-rms to match respective audio amplifiers output: 25 or 70

4) Minimum sound output intensity measured at 10-feet centerline distance, 1000Hz (dBA) and 2-watt power tap

a) Ceiling mounted device…….96dBA
b) Wall mounted device……..……93dBA

5) Maximum audio distortion at specified sound output, frequency ranges and wattage rating: 4%

6) Frequency Response Range at ±3dB: 400Hz to 4000Hz

7) Minimum audio dispersion angle symmetrical pattern: 150 degrees

8) Minimum operating power input range in watts, to allow adjusting of sound output intensities: 0.25 to 2.0

c. Audio speaker input transformer, multiple transformer wattage settings to allow speaker wattage selection. Not less than four taps, one tap at low rating, one tap at high rating and two intermediate tap ratings. Input voltage rating to match respective circuit amplifier output rating. Speaker output circuit to match respective speaker impedance. Install inside the speaker housing.

d. Metal, 6-inch nominal depth speaker housing flush ceiling install locations, and metal 4-inch nominal depth on semi-flush wall install locations. Housing interior shall be lined with sound dampening fire resistive material. Tamper resistant, removable, sound-transparent speaker cover grill. Red grill finish color or colors selected by Architect.

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. Seventy-five Candela (cd) minimum, 180-Candela 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 thirty 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 “sightline” together shall be synchronize flash rate.

2.07 EXISTING REMOTE FIRE ALARM ANNUNCIATOR - RFAP

Modify and reprogram the existing RFAP to fully interface with 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.

2. Individually test each automatic initiating device and verify correct alarm operation, control panel response and remote equipment operation.

3. 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.

4. Individually operate each control function.

5. 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.

6. RFAP – Remote Fire Alarm Annunciator Panel and FACP – Fire Alarm Control Panel: Test and verify each individual device and address connected to the RFAP, FACP equipment. Document each device type and address, physical location, initiation and supervisory trouble, loss of power, response time and sensitivity.

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. Each fire smoke detector, activation test with UL listed aerosol "canned-smoke".

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.

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 ensure 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 red color 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 conductor's 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.

3. Fiber optic cables, terminations and fiber optic to electrical couplers shall be UL, State Fire Marshal and AHJ listed for fire alarm system use, and as recommended by Fire Alarm Manufacturer. Provide optical to electrical couplers at all fiber optic equipment connections. Provide additional electrical power supply circuit conductors in each conduit/raceway containing fiber optic cables to supply operating voltage and current to the respective fire alarm equipment.

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 #14 AWG (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. Not more than a total of ten visual evacuation alarm devices shall be installed on any respective single circuit “run” extending from the fire alarm control panel or extending from an REMC, including “T” and “branch-tap” connections. Conductors smaller than #12AWG shall not be used for visual evacuation alarm device circuits. Conductors for visual alarm devices shall be independent of audio alarm circuit conductors:

Total Circuit Conductor Length	Minimum Wire Size
Up to 300 feet	#12AWG
301 through 600 feet	#10AWG
601 through 900 feet	#8AWG
Between buildings and over 900 feet	#6AWG

4. Not more than a total of ten audio (non-voice) evacuation alarm devices shall be installed on any respective single circuit "run" extending from the fire alarm control panel or extending from an REMC, including "T" and "branch-tap" connections. Conductors smaller than #12 AWG shall not be used for audio evacuation alarm device circuits:

Total Circuit Conductor Length	Minimum Wire Size
Up to 300 feet.	#12 AWG
301 through 600 feet.	#10 AWG
601 through 900 feet.	#8 AWG
Between Buildings and Over 900 feet.	#6 AWG

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 Mechanical, Plumbing and Architectural Drawings and Contract Documents for the location and quantity of these systems.

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 4620
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SECTION 31 1000

SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Removal of vegetation, grass, grass roots, shrubs, tree stumps, trees, upturned stumps, weed growth, tree roots, brush, masonry, concrete, rubbish, debris and other materials.

2. Removal of concrete and bituminous surfaces.

3. Removal of existing fences and gates.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 31 2200 - Grading.

3. Section 31 2313 - Excavation and Fill.

4. Section 31 2316 - Excavation and Fill for Pavement.

5. Section 31 2326 - Base Course.

1.02 SUBMITTALS

A. Shop Drawings: Submit site plan indicating extent of site clearing.

1.03 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, current edition, as a minimum requirement.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 TREE AND STUMP REMOVAL

A. Remove trees and stumps indicated or required to be removed. Remove trees, together with bulk of roots, to a minimum depth of 4 feet below required grade, and within a radius of approximately 7 feet beyond perimeter of trunk at grade.

B. Fill and compact excavation from tree and stump removal. Fill in 6 inch layers, each compacted to 90 percent of maximum density in accordance with ASTM D1557.

1. Back filling shall not commence until the excavation is inspected and tested.

3.02 CONCRETE AND BITUMINOUS SURFACING REMOVAL

A. Break up and completely remove existing concrete surfacing, curbs, gutters, walks and bituminous surfacing to indicated limits. Cutting shall be performed to a neat and even line with proper tools or a concrete cutting saw. Minimum depth of cut shall be 1 1/2-inch, unless otherwise indicated. Remove concrete broken beyond the indicated limits to the nearest joint or score line and replace with new concrete to match existing.

3.03 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 2200

GRADING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 31 1000 - Site Clearing.

3. Section 31 2313 - Excavation and Fill.

4. Section 31 2316 - Excavation and Fill for Pavement.

5. Section 31 2326 - Base Course.

1.02 PROJECT REQUIREMENTS

A. General:

1. Fees: Pay as required by authorities having jurisdiction over the area.

2. Bonds: Post as required by authorities having jurisdiction over the area.

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

4. Before grading, contact Underground Service Alert of Southern California (USASC) for information on public buried utilities and pipelines. Retain the services of an underground utility locator for on-site utilities.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall conform to requirements specified in this and related sections.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.

B. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

3.02 ROUGH AND FINE GRADING

A. Rough grade area sufficiently high to require cutting by fine grading:

1. Grade area for bituminous surfacing and other paving to the indicated grades, equal to the section of the indicated base and pavement.

2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.

3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.

4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten and roll to obtain required density and indicated finish grades.

5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.

B. Base or Subgrade:

1. After subgrade has been constructed to approximate required grades, scarify to a depth of at least 6 inches:

a. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.

b. Subgrade material shall be compacted by tamping, sheepsfoot rollers or pneumatic tire rollers. Required relative compaction shall be **90** percent minimum for the top 6 inches below subgrade.

c. Install base course in accordance with Section 31 2326 - Base Course.

2. Tolerance of completed grades of base or subgrade shall not vary more than 0.03 inch per foot from grades indicated. Provide an average grade as indicated.

3.03 SHORING

A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.

B. Design and Calculations: Provide in accordance with requirement of CalOHSA.

C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.04 EXCESS MATERIAL DISPOSAL

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 31 2313

EXCAVATION AND FILL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, filling, backfilling, and compacting for Project site pavement, planting areas, buildings, and other structures.

2. Trenches for utility lines such as water, gas, irrigation, storm drain and sewer lines, concrete-encased conduits, manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes, and other utility appurtenances.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 31 1000 - Site Clearing.

3. Section 31 2200 - Grading.

4. Section 31 2326 - Base Course.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.

2. Bonds: Post as required by authorities having jurisdiction over the area.

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 SUBMITTALS

A. Shoring calculations as required in Article 3.03 of this Section.

1.04 QUALITY ASSURANCE

A. Comply with the Standard Specifications for Public Works Construction, current edition, except as modified herein.

B. Sampling, testing, and certification of imported and exported soils shall be performed in accordance with Section 01 4524, Environmental Import/Export Materials Testing.

1.05 TESTING

A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.

B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.05 of this Section.

1.06 PROJECT CONDITIONS

A. Information on Drawings or in soil investigation report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 FILL AND BACKFILL MATERIALS

A. Fill and backfill material shall be a granular material previously removed from excavation or imported fill material, free of clods and stones larger than 3 inches, (2½ inches for utility trenches) foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.

B. Fill material exhibiting a wide variation in consistency and moisture content shall be blended and aerated to stabilize and upgrade the material.

C. Bedding material from trench bottom to one foot above the pipe:

1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.

2. Sand complying with the Specifications for cement concrete aggregates.

D. Brick rubble and broken concrete originating from the Project site shall be legally disposed of off the Project site No such material shall be imported from outside the Project site.

E. Permeable Backfill:

1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

Sieve Size:	Percentage Passing:
3/4 inch (19mm)	100
3/8 inch (10mm)	80 to 100
No. 100	0 to 8
No. 200	0 to 3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

3. Provided backing for weep-holes shall consist of two cubic feet of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete

aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.

4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system Miradrain by Mirafi, Inc., American Wick Drain, JDR Enterprises, or equal, may be provided if reviewed and approved by the ARCHITECT.

F. Cement-sand slurry shall be provided with one sack of cement per cubic yard of the mixture.

2.02 BASE MATERIALS

A. Concrete Slabs on Grade: Provide "Crushed Aggregate Base" as specified in Standard Specifications for Public Works Construction, Section 200 - Rock Materials, with 3/4 inch maximum size aggregates. Provide 3 inch thick base, unless noted otherwise.

B. Bituminous Surfacing: Provide as indicated on Drawings and specified in Section 31 2326 Base Course.

PART 3 - EXECUTION

3.01 GENERAL

A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.

B. Where the Work includes a building extension or addition on an occupied Project site, perform Work in such a manner, and at such times, as not to disrupt performance of existing utility services to existing Project site facilities. Where an interruption is necessary, obtain review from the OAR before proceeding.

C. Remove concrete or bituminous pavement to straight lines by saw cutting.

3.02 PROTECTION

A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.

B. Protect existing improvements including landscaping against damage. Repair or replace damaged items.

C. Protect existing utility services and distribution systems from damage or displacement.

D. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of two feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.

E. Shore, crib, or lag excavations and earthen banks as necessary to prevent cave in, erosion or gullying of sides.

F. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed

earth and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

3.03 SHORING

A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.

B. Design and Calculations: Provide in accordance with requirement of governing Cal-OSHA requirements.

C. Remove shoring upon completion of the Work of this Section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.04 EXCAVATION

A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork", except as modified herein.

B. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other required Work.

C. Machine-drill excavation for round footings to size and depth indicated. Provide a collar or casing, or other adequate protection, to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.

D. Provide excavation bottoms level and free from loose material. Excavate to indicated or required elevations of undisturbed earth.

E. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence in accord with Cal-OSHA standards and requirements.

F. Trenches over five feet in depth shall comply with the Construction Safety Orders of the California Division of Industrial Safety.

G. Where indicated or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

H. For Structures:

1. Calculate excavation quantities based on elevations or depths indicated on Drawings.

2. Provide 2,000 psi concrete for backfill of over-excavated areas to indicated or required elevations.

3. Special preparation of bottom of excavated planes areas: Excavate areas shown on Drawings as bottom of excavated planes (B.E.P.), by excavating and filling to indicated grades and elevations.

I. For Utilities:

1. Excavate trenches to required depth for utility lines, such as pipes, conduits, and tanks, with minimum allowance of 6 inches at the bottom and 6 inches at the sides for bedding or concrete encasement as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before placing sand bedding or concrete encasement.

2. Do not install piping lengthwise under concrete walks without review by the ARCHITECT.

3. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of two horizontal to one vertical, from a line 9 inches above bottom of footings.

   a. Unless otherwise indicated on Drawings, depth of excavations outside buildings shall provide for a minimum coverage above top of piping, tank or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finish grade
Copper Water Tube	18 inches below finish grade
Cast-Iron, Pressure Pipe	36 inches below finished grade
Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structure	36 inches below finished grade
Soil, sewer and storm drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. Install polypropylene sewer pipe with at least 24 inches of coverage.
Irrigation Pipe:	Non-pressure pipe - 12 inches, pressure pipe - 24 inches.

   b. Trench width shall provide space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.

4. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements.

5. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits placed in the same trench or outside surfaces of containers and tanks.

3.05 IMPORT/EXPORT OF MATERIALS

A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300 - Earthwork, except as modified herein. Install and compact fill in layers not to exceed 6 inches in thickness.

B. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

C. In addition to the requirements of this Section, import and/or exported materials shall comply with the requirements of Section 01 4524, Environmental Import/Export Materials Testing.

D. Imported fill materials shall be sampled by the Geotechnical Engineer, for compliance with the requirements of Part 2 of this Section.

E. The Geotechnical Engineer, will submit the samples to an independent DSA approved testing laboratory for testing.

F. Initial sampling and testing shall be performed before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and entity responsible for the source site. The Geotechnical Engineer, will obtain both the initial and additional samples from the identified site and submit samples for required testing.

G. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

H. The independent approved testing laboratory will perform the required tests and report results of tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, California Building Code, and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer will submit a verified report to the DSA as required by the CBC.

I. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.

J. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.06 INSTALLATION OF MATERIALS

A. Pavement: Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the Geotechnical Engineer, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but not more than 1 in 20. Provide adequate drainage at all times during installation of the Work of this Section.

B. Structures:

1. After concrete has been placed, forms removed, and concrete Work inspected, backfill excavations with earth to indicated or required grades. Backfill simultaneously on each side of walls or grade beams. Remove rubbish, debris and other waste materials from excavations before placing backfill.

2. Before placing backfill, adequately cure concrete and provide bracing, if required to stabilize structure. Protect waterproofing or damp-proofing against damage during backfilling operations, with required protection board. Remove bracing as backfill operation progresses.

3. Do not furnish or install expansive soils for retaining wall backfill.

4. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished. Do not over-saturate or compact by flooding or jetting.

5. Install wall backfill before installing railings and fences on walls.

6. Install weep hole drainage at the backside of walls so the backing completely covers the weep holes, is horizontally centered and extends at least 12 inches above the bottom of the weep opening. Provide an 8-inch square section of 1/4 inch galvanized or aluminum screen, with a minimum wire diameter of 0.03 inch, and install at the backside of each weep hole before installing the backfill material.

7. Where a reviewed drainage matting system is provided instead of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.

C. Utilities:

1. Do not install backfill until the Work of this Section has been inspected and tested. Do not furnish or install materials excavated from the Project site containing materials not permitted for backfill.

2. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the IOR.

3. Install backfill in layers not exceeding 4 inches in thickness, except cement-sand slurry.

4. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grades plus one inch.

3.07 COMPACTING

A. Each layer of fill material shall be compacted by tamping, sheepsfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.

B. Install and compact sand bedding to provide a uniform bearing under the full length of piping and conduits.

C. Unless otherwise indicated, compact each layer of fill material to a relative compaction of at least ninety percent.

D. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each layer of compacted fill before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

A. The Geotechnical Engineer will inspect and test excavations, sample material quality for testing as set required in Part 2, and observe installation and compaction of fill materials.

B. The Geotechnical Engineer will sample imported fill materials from their designated source and submit samples to the independent approved testing laboratory before delivery to the Project site.

C. Installation of backfill shall be observed by the Geotechnical Engineer.

D. The Geotechnical Engineer will inspect and test excavation Work before the installation of fill and other materials.

E. Compaction: Test compaction in accordance with ASTM D1557, Method C.

F. The Project Inspector will inspect foundation excavations when completed and ready for forms, after forms are in place, and before first placement of concrete.

3.09 PROTECTION

A. Protect the Work of this Section until Substantial Completion.

3.10 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 2316

EXCAVATION AND FILL FOR PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfill, and compacting for paved areas.

2. Installation of fill materials.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 31 1000 - Site Clearing.

3. Section 31 2200 - Grading.

4. Section 32 2326 - Base Course.

5. Section 32 1216 - Asphalt Paving.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.

2. Bonds: Post as required by authorities having jurisdiction over the area.

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, current edition, except as modified herein.

1.04 TESTING

A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.

B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.05 of this Section.

1.05 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 BASE MATERIALS

A. Concrete Slabs On Grade: Provide “Crushed Aggregate Base “as specified in the Standard Specifications for Public Works Construction, Section 200: “Rock Materials,” with ¾ inch maximum size aggregates. Provide 3-inch thick base, unless noted otherwise.

B. Bituminous Surfacing: As indicated on Drawings and specified in Section 31 2326 - Base Course.

2.02 FILL AND BACKFILL MATERIALS

A. Fill and backfill materials shall be previously excavated materials or imported fill material, free of clods and stones larger than 3-inch, foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.

B. Fill material exhibiting a wide variation in consistency and moisture content shall be blended or aerated to stabilize and upgrade the material.

C. Imported Fill Material:

1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.

2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing 200 mesh sieve. Material shall have a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported material shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

D. Brick rubble and broken concrete originating from the Project site shall be legally disposed of off the Project site. No such materials shall be imported from outside the Project site.

E. Permeable Backfill:

1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

Sieve Size:	Percentage Passing:
3/4 inch (19mm)	100
3/8 inch (10mm)	80 to 100

No. 100	0 to 8
No. 200	0 to 3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

3. Provided backing for weep holes shall consist of two cubic feet of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.

4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system, Miradrain by Mirafi, Inc., or equal, may be provided if reviewed and approved by the ARCHITECT.

PART 3 - EXECUTION

3.01 GENERAL

A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.

B. Clear the Project site as indicated in Section 31 1000 - Site Clearing.

3.02 PROTECTION

A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, Cal-OSHA regulations.

B. Protect adjacent existing improvements including landscaping against damage.

3.03 EXISTING UTILITY LINES

A. Protect existing utility lines from damage or displacement.

B. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of 2 feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.

3.04 EXCAVATION

A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.

3.05 FILL

A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.

B. Provide fill materials as specified in Part 2 - Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

C. In addition to the requirements of this Section, import and/or exported materials shall comply with the requirements of Section 01 4524 - Environmental Import/Export Materials Testing.

D. Imported fill materials will be sampled by the Geotechnical Engineer for compliance with the requirements of Part 2 of this Section.

E. The Geotechnical Engineer will submit samples to a DSA approved independent approved testing laboratory for testing.

F. Initial sampling will be performed by the Geotechnical Engineer before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The Geotechnical Engineer will obtain both the initial and additional samples from the identified site and will submit samples to the approved independent testing laboratory for testing.

G. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

H. The independent approved testing laboratory will perform the required tests and report results of tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, CBC, and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer shall submit a verified report to the DSA as required by CBC.

I. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.

J. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.06 INSTALLATION OF MATERIALS

A. Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the Geotechnical Engineer, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but no more than 1 in 20. Provide adequate drainage at all times during construction of the Work of this Section.

3.07 COMPACTING

A. Each layer of fill material shall be compacted by tamping, sheepsfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.

B. Unless otherwise indicated, compact each layer of earth fill to a relative compaction of at least 90 percent.

C. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each compacted layer before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

A. The Geotechnical Engineer will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.

B. The Geotechnical Engineer will sample imported fill materials from their designated source before delivery to the Project site.

C. Installation of backfill will be observed by the Geotechnical Engineer.

D. The Geotechnical Engineer will inspect and test excavation Work before the installation of fill and/or other materials.

E. Compaction: Test compaction in accordance with ASTM D1557, Method C.

3.09 PROTECTION

A. Protect the Work of this Section until Substantial Completion.

3.10 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 2326

BASE COURSE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Installation of base material.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 31 1000 - Site Clearing.

3. Section 31 2200 - Grading.

4. Section 31 2313 - Excavation and Fill.

5. Section 31 2316 - Excavation and Fill for Paving.

7. Section 32 1216 - Asphalt Paving.

1.02 SUBMITTALS

A. Crushed aggregate base (CAB) shall consist of native rock without naturally occurring asbestos or recycled materials. The CONTRACTOR shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by OWNER'S Office of Environmental Health and Safety (OEHS) prior to importing the material. A statement on company letterhead from the CAB source, stamped by either a California Professional Geologist or Engineer, which states that the subject materials are native rock, do not contain any recycled materials and that the source quarry does not mine ultramafic materials, a source of natural occurring asbestos shall be included in the submittal to OEHS. The CONTRACTOR may request variance from analytical testing required by Section 01 4524 for CAB. To be considered for a variance, the CONTRACTOR shall submit a documentation package for OEHS approval, which includes all of the aforementioned information at least 48 hours in advance of planned import.

1. Frequently used suppliers for LAUSD projects include:

a. Hansen Aggregates.

b. Vulcan Materials, Reliance Company.

c. Vulcan Materials Durbin.

C. Product Data: Submit material source, technical information and test data for base materials. Gradation and quality certifications shall be dated within 30 days of the submittal.

D. Sample: Submit sample of proposed base course material.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Crushed Aggregate Base (CAB) materials shall conform to the requirements of the Standard Specifications for Public Works Construction: Section 200 - Rock Materials.

B. Crushed Miscellaneous Base (CMB) or materials generated on site shall not be used as a base course material.

2.02 MATERIAL APPROVAL

A. Base material shall be inspected by the Project Inspector for gradation and material content prior to installation. The OWNER may choose to have additional tests performed by a geotechnical engineer, retained by the OWNER, before installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install base course material in layers not exceeding 4 inches in thickness, unless required otherwise. Grade and compact to indicated levels or grades, cut and fill, water and roll until the surface is hard and true to line, grade and required section. Provide a relative compaction of at least 95 percent, unless otherwise required.

B. Grade base course to elevations indicated on Drawings, ready to receive surfacing, in accordance with Section 31 2200 - Grading.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 0117

ASPHALT PAVEMENT REPAIR

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bituminous Surfacing Repair: Areas removed for utility trenches, heaved by tree roots, cracked areas, protruding areas where pavement meets hard surfaces, depressed areas, holes and areas around new structures, and raveled bituminous pavement.

2. Areas heaved by tree roots, cracked areas, holes and trenches, and areas around new structures.

B. Related Sections:

1. Division 01 - General Requirements.

2. Section 31 2200 - Grading.

3. Section 32 1216 - Asphalt Paving.

4. Section 32 1313 - Site Concrete Work.

5. Section 32 1236 - Seal Bituminous Surfacing.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating areas to be repaired.

B. Product Data: Submit manufacturer’s technical data for materials and products.

1.03 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, 2021 edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Base course materials: Section 31 2200 - Grading.

B. Asphalt paving materials: Section 32 1216 - Asphalt Paving.

C. Seal materials: Section 32 1236 - Seal Bituminous Surfacing.

D. Headers: Section 32 1216 - Asphalt Paving.

2.02 BITUMINOUS MATERIALS

A. Provide materials and products of the class, grade or type indicated, conforming to relevant provisions of Section 203 - Bituminous Materials of the latest Standard Specifications for Public Works Construction.

PART 3 - EXECUTION

3.01 PAVEMENT REMOVAL

A. Remove bituminous and concrete pavement in accordance with applicable provisions of Section 300 - Earthwork of the Standard Specifications for Public Works Construction.

B. Pavement Heaved By Roots: Remove pavement to limits of distortion and expose roots. Trim roots to provide at least 12-inch clearance to pavement.

C. Remove protruding bituminous surfaces flush with the surrounding grade using a suitable tool or equipment so that adjacent finishes are not blackened.

D. Remove raveled and depressed bituminous pavement to limits indicated or required.

E. Saw cut existing improvements, trim holes and trenches in bituminous and concrete pavement to permit mechanical hand tampers to compact the fill.

F. Remove broken concrete by saw cutting. If the required cut line is within 30 inches of a score or joint line or edge, cut and remove to the score, joint line, or edge.

3.02 EXCAVATING, BACKFILLING AND COMPACTING

A. Conform to requirements in Section 31 2200 - Grading.

B. Where subgrade or base is deemed to be unstable or otherwise unsuitable, excavate such materials to firm earth, and replace with a required material. Install and compact fill materials in accordance with the requirements of related Specification sections.

3.03 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of the adjacent undisturbed grade.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid earth a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of two 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 devices as required to fasten headers.

3.04 BASE COURSE

A. Unless otherwise indicated, base course shall be crushed aggregate base or crushed miscellaneous base 4 inches thick or equal to thickness of the existing base, whichever is greater.

B. Fill grade and compact as specified in Section 31 2200 - Grading.

3.05 RESURFACING

A. Holes and Trenches: Remove loose dirt and backfill with cement-sand slurry allowing for surfacing one inch thicker than existing. Resurface flush with existing adjoining pavement installing the same type of materials and section provided in existing improvements.

B. Other Areas: Other surface improvements damaged or removed shall be cut to a neat even line and excavated one inch below the bottom of the existing pavement. Resurface by following the original grades and installing the same type of materials provided in existing improvements.

C. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth materials before asphalt cools.

3.06 REPAIRING AND RESEALING EXISTING SURFACES

A. Preparation of Surfaces: Prior to filling cracks, clean existing bituminous surfacing of loose and foreign materials and coat with a film of asphalt emulsion.

B. Repair of Existing Surfacing:

1. Fill cracks ½ inch wide and less with RS-1 emulsion and silica sand or other required material. Cracks larger than ½ inch wide shall be filled with Type C2 Asphalt Concrete as specified. Cracks shall be filled to the level of adjacent surfacing.

2. Where low areas, holes, or depressions occur in existing surfacing, repair with emulsified asphalt. Install material, strike off the emulsified asphalt with a straightedge flush with adjoining surfacing. Finish with a steel trowel, and after dehydration, compact by rolling or tamping.

C. Testing: Flood test entire area in presence of the Project Inspector. Entire area tested shall be free of standing water or puddles.

D. Surface Seal: After surface has been repaired and tested, install seal coat over entire area indicated. Surface seal shall be as specified in Section 02786 - Seal for Bituminous Surfacing.

3.07 CLEANING

A. Remove all stains on the Project site and adjacent properties caused by or attributed to the Work of this section.

B. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.08 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 32 1216

ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Paving for playground, parking areas, areas between buildings, synthetic track surfacing adjacent to planting and turf areas as indicated.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 31 2200 - Grading.

3. Section 31 2326 - Base Course.

4. Section 32 1236 - Seal for Bituminous Surfacing.

1.02 SUBMITTALS

A. Shop Drawings: Submit site plan indicating extent of paving and accessories.

B. Product Data: Manufacturer’s technical data for materials and products.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction.

1.04 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

B A copy of the soils report is available for examination in the office of the Architect during regular office hours of the Architect.

PART 2 - PRODUCTS

2.01 BITUMINOUS MATERIALS

A. Provide materials of the class, grade, or type indicated on the Drawings, conforming to relevant provisions of Section 203 - Bituminous Materials of the Standard Specifications for Public Works Construction.

2.02 HEADERS

A. Concrete: Per specification Section 32 1313 - Site Concrete Work.

B. Wood:

1. Redwood, Construction Heart Grade, size 2 by 6, unless otherwise indicated.

2. Stakes: 2 by 4 redwood or 2 by 3 Douglas fir, Construction Grade.

3. Nails: Common, galvanized, 12d minimum.

PART 3 - EXECUTION

3.01 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Where wood headers are indicated on drawing, fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on center with top of stakes set one inch below top of header. Provide a minimum of two 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.

3.02 CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

A. Thickness of Surfacing: Unless otherwise indicated on Drawings or specified, install bituminous surfacing to a compacted thickness of 2 inches.

B. Provide surfacing material over base course as specified in Section 31 2326 - Base Course.

C. Surfaces of walls, concrete, masonry, or existing bituminous surfacing indicated to be in direct contact with installed bituminous surfacing shall be cleaned, dried and uniformly coated with an asphaltic emulsion film.

D. Thicken edges of bituminous surfacing that do not abut walls, concrete, or masonry, and edges joining existing bituminous surfaces. Remove headers at existing bituminous surfacing where new bituminous surfacing is to be installed. Thicken edges an additional 2 inches and taper to the indicated or specified thickness 6 inches back from such edges.

E. At stairways, adjust thickness of paving such that the first tread is equal in height to all other treads.

F. Provide adequate protection for concrete, planting areas, and other finish Work adjacent to areas indicated to receive bituminous surfacing.

G. Placing:

1. Do not install bituminous surfacing when atmospheric temperature is below 40 degrees F; or when fog or other unsuitable weather conditions are present. Temperature of mixture at time of installation shall not be 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 surfacing is indicated or specified, install surfacing in one course. Where surfacing is indicated or specified 4 inches or more in thickness, except for thickened edges, install bituminous surfacing in courses of approximately equal thickness, each course not exceeding 2 ½ inches in thickness.

H. 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. Continuous screeds may be provided instead of stakes.

I. Spreading: Install bituminous surfacing in a manner to cause least possible handling of mixture. In open areas and wherever practicable, install by mechanical means with a self-propelled mechanical spreader. In confined or restricted areas, install mixture with hot shovels and rakes, and smooth with lutes.

J. Joints: Provide vertical joints between successive runs. Install joints true to line, grade, and cross section. Lapped joints are not permitted.

K. Rolling:

1. Finish roll with a self-propelled tandem roller weighing at least 8 tons. Break down roll with a self-propelled roller weighing between 1 ½ tons and 8 tons.

2. Roll in a manner that preserves flow lines and the established finished grades. Break down roll in areas adjacent to flow lines parallel to flow lines. Break down roll after bituminous surfacing is installed without shoving or cracking of mixture under roller. Continue finish rolling until surfacing is unyielding, true to grade, and meets requirements for specified smoothness. 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 bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth to properly compact.

4. Compacted bituminous surfacing shall be provided with a bulk specific gravity of at least 2.31 when tested in accordance with ASTM D1188.

3.03 TOLERANCE

A. Smoothness: Surface of bituminous surfacing after rolling, shall be even, smooth and uniform in texture with no voids or rock pockets, free of roller marks or other irregularities, and not varying by more than 0.03 foot, except at local depressions or raised areas as indicated, when a 10-foot straightedge is placed on surface.

B. Grade: Finished grade shall not vary more than 0.02 foot above or below required grade. Variations within prescribed tolerance shall be compensating so that average grade and cross-section are provided.

3.04 TESTING

A. After first coat of surface seal has been installed and after a 24 hour period, the flood test shall be completed of the bituminous surfacing in presence of the Project Inspector. Repair areas of standing water or puddles and flood test locally; install surface seal and retest as necessary.

3.05 SURFACE SEALING

A. After bituminous surfacing has passed flood test, clear and allow to dry and provide one more coat of surface seal as specified in Section 32 1236 - Seal for Bituminous Surfacing.

B. Where indicated, provide multiple coats of surface seal to existing bituminous surfacing.

C. Where new bituminous surfacing joins existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.

3.06 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.07 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 1236

SEAL FOR BITUMINOUS SURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface sealer over bituminous surfacing.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 32 1216 - Asphalt Paving.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.03 QUALITY ASSURANCE

A. Comply with the Standard Specifications For Public Works Construction, current edition.

B. Agitate bulk materials during transport.

1.04 MAINTENANCE

A. Extra Materials: Provide 10 gallons in unopened containers.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide one of the following surface seals:

	Product Name	Manufacturer
1.	Guard-Top	CALMAT / Industrial Asphalt
2.	Over Kote	Diversified Asphalt Product
3.	Park Top	Western Colloid Products
4.	Sure Seal	Asphalt Coating Engineering
5.	Super Drive Top.	SAF– T Seal. Inc.

6. Equal.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Thoroughly wash surfaces with water to remove dirt, debris, excessive oil and grease, or other foreign matter.

3.02 APPLICATION

A. Install seal coat in strict accordance with manufacturer's written directions and recommendations.

B. Install two coats of surface seal to new bituminous surfacing. First coat shall be installed before flood testing. Clean surface and allow to dry before installing second coat. Second coat shall be installed after bituminous surfacing has passed flood test.

C. Where new bituminous surfacing is installed adjacent to existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.

D. Where existing bituminous surfacing is indicated to be patched and sealed, install two coats of surface seal after patching. Refer to Section 32 1216 - Asphalt Paving.

3.03 PROTECTION OF SURFACES

A. Protect sealed and unsealed surfaces from damage and traffic during performance of the Work of this section and until surface seal has thoroughly set and cured. Do not permit traffic of any kind for at least 24 hours after completion of installation.

B. Protect the Work of this section until Substantial Completion.

3.04 TESTING

A. Owner reserves the right to obtain samples, perform tests to ensure compliance with the Specifications, and to review weight slips and invoices of materials delivered to the Project site.

3.05 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 1313

SITE CONCRETE WORK

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the Contract Documents.

B. The following types of concrete shall be covered in this Section:

1. Portland cement concrete pavement, cement walks, flatwork, curbs, gutters, retaining curbs, swales, trash pick-up areas, ramps, mowing strips, fence post footings, sliding gate concrete, catch basins, pipe bedding and encasements, transition structures, flagpoles and light standard bases and footings, splash blocks and equipment pads.

2. Portland cement concrete paving shall be stable, firm and slip resistant and shall comply with CBC sections 11B-302 and 11B-403.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference specifications of the GENERAL REQUIREMENTS.

B. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction (“GREENBOOK”), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the “Standard Specifications”.

C. Comply with the current provisions of the following Codes and Standards.

1. Federal Specifications:

a. UU-B-790A (Int.Amd. 1) Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).

2. Standards:

a. ACI 214 Recommended Practice for Evaluation of Strength Test Results of Concrete.

b. ACI 301 Specifications for Structural Concrete for Buildings.

c. ACI 315 Details and Detailing of Concrete Reinforcement.

d. ACI 318 Building Code Requirements for Reinforced Concrete.

e. ACI 347 Recommended Practice for Concrete Formwork.

f. ACI 350 Recommended Practice for Sanitary Structure.

g. ASTM C 31 Practices for Making and Curing Concrete Test Specimens in the Field.

h. ASTM C 33 Specification for Concrete Aggregates.

i. ASTM C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens.

j. ASTM C 40 Test Method for Organic Impurities in Fine Aggregates for Concrete.

k. ASTM C 42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

l. ASTM C 78 Specification for Flexural Strength.

m. ASTM C 88 Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.

n. ASTM C 94 Specification for Ready-Mixed Concrete.

o. ASTM C 114 Method for Chemical Analysis of Hydraulic Cement.

p. ASTM C 131 Test Method for Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

q. ASTM C 136 Method for Sieve Analysis of Fine and Coarse Aggregate.

r. ASTM C 143 Test Method for Slump of Portland Cement Concrete.

s. ASTM C 150 Specification for Portland Cement.

t. ASTM C 156 Test Method for Water Retention by Concrete Curing Materials.

u. ASTM C 157 Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.

v. ASTM C 172 Specification for Sampling Fresh Concrete.

w. ASTM C 192 Method of Making and Curing Concrete Test Specimens in the Laboratory.

x. ASTM C 260 Specification for Air-Entraining Admixtures for Concrete.

y. ASTM C 289 Test Method for Potential Reactivity of Aggregates (Chemical Method).

z. ASTM C 311 Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

aa. ASTM C 494 Specification for Chemical Admixtures for Concrete.

bb. ASTM C 618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

cc. ASTM D 1751 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

dd. ASTM E 119 Method for Fire Tests of Building Construction and Materials.

1.03 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with GENERAL REQUIREMENTS.

B. The following submittals and specific information shall be provided.

1. Mix Designs: Prior to beginning the WORK, the CONTRACTOR shall submit to the ENGINEER, for review, and approval, preliminary concrete mix designs for each class and type of concrete specified herein. The mix designs shall be designed by an independent testing laboratory acceptable to the ENGINEER. All costs related to such mix design shall be borne by the CONTRACTOR.

a. Each concrete mix submittal shall contain the following information:

1) Slump on which the design is based.

2) Total gallons of water per cubic yard.

3) Brand, type, composition and quantity of cement.

4) Brand type, composition and quantity of fly ash.

5) Specific Gravity and gradation of each aggregate.

6) Ratio of fine to total aggregate per cubic yard.

7) Weight (surface dry) of each aggregate per cubic yard.

8) Brand, type, and ASTM designation, active chemical ingredients and quantity of each admixture.

9) Copy of the Building and Safety Research Report Approval for each concrete admixture.

10) Air content.

11) Compressive strength based on 7 day and 28 day compression tests, including standard deviation calculations, corroborative data (if applicable), and required average comprehensive strength per ACI 318, Section 5.

12) Time of initial set.

13) Certification stamp and signature by a Civil or Structural engineer registered in state of California.

14) Certificate of Compliance for Cement.

2. Certified Delivery Tickets: Where ready-mix concrete is used, the CONTRACTOR shall provide certified weighmaster delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the public weighmaster's signature, and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the

plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

3. When a water reducing admixture is to be used, the CONTRACTOR shall furnish mix designs for concrete both with and without the admixture.

4. The CONTRACTOR shall furnish a Certificate of Compliance signed by the supplier identifying the type of fly ash and stating that the fly ash complies with ASTM C 618 and these Specifications, together with all supporting test data prior to the use of the fly ash the sample represents. The supporting data shall also contain test results confirming that the fly ash in combination with the cement and water to be used meets all strength requirements and is compatible with air-entraining agents and other admixtures.

5. The CONTRACTOR shall submit to the ENGINEER for review the design mix for fly ash concrete together with the design mix for portland cement (non-fly ash) concrete as specified in this Section.

1.04 QUALITY ASSURANCE

A. Testing for Portland Cement Concrete shall be sampled and tested in accordance with the ASTM and California Tests listed in the Standard Specifications for Public Works Construction, Latest Edition, Section 201-1.1.5.

B. Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

C. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the CONTRACTOR.

D. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the Owner, and the CONTRACTOR shall provide assistance and facilities to the INSPECTOR in obtaining samples, and disposal and cleanup of excess material.

E. Curbs and gutters shall be staked by a Land Surveyor licensed to practice in the State of California.

F. Job Mock-Up

1. General

a. Make samples on-site; revise as required; obtain Architect's approval, 10 days prior to casting finished work.

b. Finished work to match approved samples.

c. Approved sample may be incorporated into the work. Retain samples until completion of all concrete work.

d. Include typical tooled joint control in sample.

2. Broom Finished Concrete; Exterior Flatwork: Provide sample, 20 s.f. minimum area.

3. “Sacked” Vertical Surface; Exterior Wall: Provide sample, 5 sf. minimum area.

G. Construction Tolerances: The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 347.

H. Construction tolerances shall not violate dimensions, grades, slopes required by CBC for accessibility requirements. Adjust work accordingly to comply with requirements.

I. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4-inch;
Variation from the level or from the grades shown.	In 10 feet: 1/4-inch;
Variation from the plumb	In 10 feet: 1/4-inch;
Variation in the thickness of slabs and walls.	Minus 1/8-inch; Plus 1/4-inch
Variation in the locations and sizes of slabs and wall openings.	Plus or minus 1/8-inch

PART 2 - PRODUCTS

2.01 CONSTRUCTION MATERIALS

A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials furnished for the work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.

C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.

D. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces. Conform to Section 303-5.2 of the Standard Specifications.

1. Use flexible or curved forms for curves of a 100-foot or less radius.

E. Reinforcing Materials: As follows:

1. Steel Reinforcing Bars: ASTM A 615 deformed grade 40 billet steel, plain finish, unless otherwise specified on Construction Document. Fabrication, sampling and jobsite handling shall conform to the requirements in ASTM Designation: D 3963, except the 2 samples shall be 30 inches long.

2. Dowels:

a. Dowel bars shall be plain round smooth conforming to the requirements in ASTM Designation: A 615/A 615M, Grade 40 except that the two samples required in ASTM Designation: D 3963/D 3963M shall be 18 inches long. Dowel bars shall be free from burrs or other deformations detrimental to free movement of the bars in the concrete

b. Dowel bars shall be lubricated with a bond breaker over the entire bar. A bond breaker application of petroleum paraffin based lubricant or white-pigmented curing compound shall be used to coat the dowel bars completely prior to placement. Oil and asphalt based bond breakers shall not be used. Paraffin based lubricant shall be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal. Paraffin based lubricant shall be factory applied. White pigmented curing compound shall conform to the requirements of ASTM Designation: C 309, Type 2, Class A, and shall contain 22 percent minimum nonvolatile vehicles consisting of at least 50 percent paraffin wax. Curing compound shall be applied in 2 separate applications, the last application not more than 8 hours prior to placement of the dowel bars. Each application of curing compound shall be applied at the approximate rate of one gallon per 15 square yards.

3. Epoxy for bonding tie bars and dowel bars to portland cement concrete shall be a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C 881, Type V, Grade 3 (Non-Sagging), Class B or C. The class used shall be dependent on the internal temperature of the hardened concrete at the time the epoxy is to be applied. Class B shall be used when the internal temperature is from 40 °F to 60 °F. Class C shall be used when the internal temperature is above 60 °F, but not higher than recommended by the manufacturer. A copy of the manufacturer's recommended installation procedure shall be provided to the Engineer at least 7 days prior to the start of work. Epoxy shall be applied in conformance with the manufacturer's recommendations.

a. Simpson Strong Tie Set-XP Epoxy (or approved equal) ICC-ES ESR-2508.

F. Concrete Materials: As follows:

1. Cement, used for site concrete, shall be standard brand portland cement conforming to ASTM C 150 for Type II. Portland cement shall contain not more than 0.60 percent alkalies. The term "alkalies" referred to herein is defined as the sum of the percentage of sodium oxide and 0.658 times the percentage of potassium oxide (Na20 + 0.658 K20). These oxides shall be determined in accordance with ASTM C 114. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the ENGINEER. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports for each shipment of cement to be used shall be submitted to the INSPECTOR.

2. Concurrent with strength design criteria, concrete shall also be proportioned to provide the requisite durability to satisfy the exposure conditions imposed by either environment and/or service. Durability, in this context, refers to the ability of the concrete to resist deterioration from the environment or service in which it is placed. Concrete proportioned in accordance with ACI 318, chapter 4, Durability Requirements, will meet this criteria.

3. Combined Aggregate: 1" maximum coarse aggregate size conforming to Grading C of Standard Specifications Section 201-1.3.2(A). Aggregates shall be obtained from pits acceptable to the INSPECTOR, shall be non-reactive, and shall conform to ASTM C 33.

4. Water: Shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies.

5. “Pea gravel” mix is not acceptable, unless specifically approved in writing by the Civil Engineer of Record prior to construction.

G. Admixtures:

1. The ENGINEER may require the use of admixtures or the CONTRACTOR may propose to use admixtures to control the set, effect water reduction, and increase workability. In either case, the addition of an admixture shall be at the CONTRACTOR's expense. The use and continued use of an admixture shall be approved by the ENGINEER. Admixtures specified herein, other than calcium chloride, shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used. Admixtures shall contain no free chloride ions, be non-toxic after 30 days, and shall be compatible with and made by the same manufacturer as the air entraining admixture.

2. These admixtures shall not be used in greater doses than those recommended by the manufacturer or permitted by the ENGINEER. The permitted dosage of the admixture shall not exceed that which will result in an increase in the driving shrinkage of the concrete in excess of 20 percent when used in precast or prestressed concrete, or 10 percent when used in any other structural concrete. The strength of concrete containing the admixture in the amount of proposed shall, at the age of 48 hours and longer be not less than that of similar concrete without the admixture. The admixture shall not adversely affect the specified air content, unless permitted by the ENGINEER.

3. Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture such as [Sika Chemical Corporation's Plastiment], [Master Builder's Pozzolith 300R], or equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a set accelerating admixture such as [Sika Chemical Corporation's Plastocrete 161FL], [Master Builder's Pozzolith 50C], or equal shall be used.

4. Low range water reducer shall conform to ASTM C 494, Type A. It shall be either a hydroxylated carboxylic acid type or a hydroxylated polymer type. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.

5. High range water reducer shall be sulfonated polymer conforming to ASTM C 494, Type F or G.

   a. If the high range water reducing agent is added to the concrete at the batch plant, it shall be second generation type, [Daracem 100, as manufactured by W.R. Grace & Co.]; [Pozzolith 430R, as manufactured by Masterbuilders]; or equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified.

b. If the high range water reducer is added to the concrete at the job site, it shall be used in conjunction with a low range water reducer and shall be [Pozzolith 400N and Pozzolith MBL82, as manufactured by Masterbuilders]; [WRDA 19 and WRDA 79, as manufactured by W.R. Grace & Co.]; or equal. Concrete shall have a slump of 3-inches ± 1/2-inch prior to adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

6. Air-entraining agent meeting the requirements of ASTM C 260, shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 4 percent; provided that, when the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the total air content provided shall be 5 to 6 percent. The Owner reserves the right, at any time, to sample and test the air-entraining agent received on the job by the CONTRACTOR. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.

7. Calcium Chloride: Except as otherwise provided herein, calcium chloride will not be permitted to be used in concrete.

8. Fly ash/pozzolan shall conform to ASTM C 618 and the following supplementary requirements:

   a. Class F fly ash

o Loss on ignition,	maximum 4 percent
o S03 content,	maximum 3 percent
o Moisture content,	maximum 1 percent

   b. Class F fly ash, as a percent by weight of total cementitious material, shall not exceed 15 percent

   c. When Sulfate Resistant or Special Exposure Concrete is specified, test results shall be submitted to the Engineer as specified in Section 2-5.3 of the Standard Specifications. The test result shall show that the fly ash to be used is effective in contributing to sulfate resistance in conformance with ASTM C618, Table 3 (optional physical requirements) as tested in accordance with ASTM C 1012. The data submitted shall be less than 6 months old.

H. Curing Materials:

1. Concrete curing compound shall conform to the requirements of ASTM C309 Type 1-D (clear or translucent with a fugitive dye), Class B (Resin Type Only), except the loss of water shall not exceed 0.15 kilograms per square meter in 24 hours nor 0.45 kilograms per square meter in 72 hours when tested in accordance with ASTM C 156. The CONTRACTOR shall provide, when requested by the ENGINEER, certified copies of vendor's test report showing compliance with ASTM C 309 and these specifications. The testing and the report shall be supplied without cost to the Agency. All compounds shall be furnished by the CONTRACTOR in sealed original containers labeled in accordance with ASTM C 309 and with the date of manufacture.

2. Polyethylene sheet for use as concrete curing blanket shall be white and conform to ASTM C 171. The loss of moisture when determined in accordance with the

requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.

3. Polyethylene-coated burlap for use as concrete curing blanket shall conform to ASTM C 171. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

I. Expansion Joint Filler Material

1. Curb & Gutter: Nonextruding and Resilient Filler: Celotex "Flexcell", or approved equal, 1/4-inch thick material conforming to ASTM D 1751.

2. Concrete Walk and Slab: Joint filler material shall be preformed expansion joint filler conforming to the requirements of ASTM D994. A Certificate of Compliance for the joint filler material shall be furnished to the Engineer. The certificate shall be accompanied with a certified test report of the results of the required tests performed on the joint filler material within the previous 12 months prior to proposed use. The certificate and accompanying test report shall be provided for each lot of joint filler material prior to use on the project.

3. Silicone Joint Sealant: Premium-grade, high-performance, moisture-cured, single-component, polyurethane-based, non-sag elastomeric sealant. Meets Federal specification TT-S-00230C. Meets ASTM C-920, Type S, Class 25 or 35; Grade NS, Use T or NT, Shore A Hardness (21 day) 35-45. A Certificate of Compliance for the silicone sealant shall be furnished to the Engineer. The Certificate shall also be accompanied with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. The Certificate and accompanying test report shall be provided for each lot of silicone joint sealant prior to use on the project.

a. Sika Corporation, Sikaflex-1A.

b. Tremco, Inc., Dymonic.

c. Tremco, Inc., Vulkem 116.

d. Bostik Construction Products Div., Chem-Calk 900.

J. Concrete Sealer: For natural concrete only, HLQ-125 as manufactured by SINAK Corp., San Diego, CA (619/231-1771), HLQ-125 as manufactured by SINAK Corp., San Diego, CA (619/231-1771), or equivalent product of another manufacturer in accordance with the "or equal" provision of the Contract Documents, penetrating sealer that interacts with mineral compounds and siliceous materials in portland cement concrete to produce more dense, non-dusting surface.

K. Related Materials: As follows:

1. Damp-proofing agent shall be an asphalt emulsion, Sonneborn Hydrocide 660, or approved equal.

2. Epoxy adhesives shall be the following products for the applications specified:

a. For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur Hi-Mod Epoxy Adhesive, as manufactured by Sika Chemical Corporation, or approved equal.

b. For bonding hardened concrete or masonry to steel, Sikadur Hi-Mod Gel or approved equal.

L. Flatwork, Curbs / Curb & Gutter Mix Design: At a minimum, concrete for flatwork, curbs and curbs & gutters shall conform to the Standard Specifications for Public Works Construction, Section 201-1.1.2, mix class 520-C-2500:

1. Compressive Strength: minimum of 2,500 psi at 28 days compressive strength.

2. Slump Limit: 4 inches at point of placement.

3. Cement per cu yard (sacks): 5.5 (minimum).

4. Air Content: 4% +/- 1% percent.

M. Slurry Mix Design:

1. Compressive Strength: 100 psi at min. 28 days compr. strength.

2. Slump Limit: 5 inches at point of placement.

3. Cement per cu yard (sacks): 1.0

4. Aggregate Gradation: “E” per S.S.P.W.C. table 201-1.3.2(A).

5. Air Content: 4% +/- 1% percent.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES FOR CONCRETING

A. General: Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. Subgrade Preparation:

1. Per the project soils report, a minimum of two (2) feet of engineered fill is required under concrete pavement. The existing soil may be utilized as engineered fill. The fill should be moistened to 120 percent of optimum moisture content and compacted to a minimum of 90 percent relative compaction and verified by the geotechnical representative.

2. Exposed bottoms under engineered fill should be scarified a minimum of 6-inches, moisture conditioned to 120 percent of optimum moisture content and compacted to a minimum 90 percent relative compaction per ASTM D 1557.

C. The compacted surface shall be firm, hard and unyielding. The term "firm, hard and unyielding" as used in S.S.P.W.C. Section 301-1.3 shall mean that when the heaviest construction and hauling equipment used on the project drives over the subgrade, no permanent deformation shall occur either before or during pavement construction. On areas where the underlying material appears to be wet or soft, or where it deflects under wheel loads, the Contractor shall employ excavation and work techniques which do not worsen the subgrade condition.

D. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual scarification or over-excavation depths will have to be determined on the basis of in-grading observations and testing performed by representatives of the project geotechnical consultant.

E. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the Geotechnical Engineer to verify that the over-excavation depths, shown on the construction drawings for concrete pavement structural sections, have been achieved prior to re-compaction.

F. Joints in Concrete: Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by sandblasting followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

G. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and ACCEPTED by the INSPECTOR at least 24 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

H. All inserts or other embedded items shall conform to the requirements herein.

I. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the INSPECTOR before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

J. Where concrete is to be cast against old concrete, (greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand-blasting, exposing the aggregate. In concrete shear-walls, suspended slabs and roof slabs, the interface surface at construction joints shall be roughened to a full amplitude of one quarter inch. The hardened surface shall be cleaned of all latent foreign material and washed clean, prior to the application of an epoxy bonding agent.

K. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the ENGINEER.

L. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

M. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.

N. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

O. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.02 HANDLING, TRANSPORTING, AND PLACING

A. General: Placing of concrete shall conform to the applicable requirements of ACI 301 and the requirements of this Section.

B. The total elapsed time between the addition of water at the batch plant and the completion of the discharge of the P.C.C. from the mixer shall not exceed 90 minutes. All P.C.C. remaining in the mixer after said 90-minute time limit shall be rejected and removed from the project site.

C. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the CONTRACTOR.

D. Whenever batch trucks or other paving equipment cause rutting of the subgrade or subbase in concrete placement areas, inspectors shall immediately stop construction. Construction shall not be allowed to resume until distorted subgrade or subbase is repaired. Contractors and inspectors should locate by proof rolling, any questionable unstable areas in advance to avoid distortion under equipment. Wet, unstable areas must be dried out or replaced before starting placement of asphalt. Locating wet or soft areas in advance can be accomplished by testing finished subgrade or subbase with a loaded truck. Construction of concrete pavement should not proceed unless testing gives a reasonable indication that distortions will not occur during construction of overlying pavement. When repair, aeration, and recompaction are required to correct damage from Contractor's operation, all necessary repair will be done at Contractor's expense. However, if the Engineer determines that additional depth of aeration and recompaction are needed, that should be paid by change order.

E. All pull boxes, meter boxes, valve covers and manholes shall be adjusted to proposed finish grade prior to placement of the P.C.C.

F. Dowel Placement:

1. Dowel bars shall be centered on the joint within a tolerance of ±2 inches in the longitudinal direction directly over the contact joint or sawcut for the transverse weakened plane joints, as shown on the plans. Prior to placement of dowel bars, the Contractor shall submit to the Engineer a written procedure to identify the transverse weakened plane joint locations relative to the middle of the dowel bars and the procedure for consolidating concrete around the dowel bars.

2. Dowel bars shall be placed at longitudinal joints as shown on the plans. Dowel bars shall be placed as shown on the plans by using mechanical insertion. When dowel bars are placed by mechanical insertion, the concrete over the dowel bars shall be reworked and refinished so that there is no evidence on the surface of the completed pavement that there has been any insertion performed. When drill and bonding of dowel bars is performed at contact joints, a grout retention ring shall be used.

G. Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the project inspector, all subject to the observation of the engineer or architect.

H. Casting New Concrete Against Old: An approved epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where waterstop is installed.

I. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the INSPECTOR. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

J. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the pour. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

K. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.

L. Cold Weather Placement: Earth foundations shall be free from frost or ice when concrete is placed upon or against them. Fly ash concrete shall not be placed when the air temperature falls below 50 degrees F.

M. A transverse construction joint shall be constructed, including dowel bars, at the end of each day's work or where concrete placement is interrupted for more than 30 minutes, to coincide with the next contraction joint location. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of excess concrete shall be at the Contractor's expense. Excess material shall become the property of the Contractor and shall be disposed of. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of dowel bars.

N. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. The finished surface shall be free from humps, sags, blemishes or other irregularities Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

O. Broom Finish Type:

1. Surfaces Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.

2. Surfaces Sloped greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

P. Joints:

1. Joints: Joints in concrete curb, gutter, and walk shall be designated as expansion joints and control joints. Joints for concrete flatwork shall be provided as noted on the architectural plans. Expansion joints for swales, curbs / curb & gutter shall be placed at no greater than 15 feet on center or as indicated on construction drawings.

a. Expansion Joints: Provide 1/2" premolded joint filler, material meeting Section 2.01I herein. Construct expansion joints in conformance with Standard Specification Section 303-5.4.2 and the details on the construction documents.

1) Extend expansion joint fillers full-width and depth of joint, and 1/4" below finished surface where joint filler is indicated. If no joint sealer is called for, place top of premolded joint filler flush with top of concrete or curb.

2) Where silicone joint sealer is noted on the construction documents, the premolded joint filler strips shall be placed 1" below the surface of the concrete or curb, the full width of the expansion joint. The remainder of all joints shall be filled to within 1/4" below the surface of the concrete with the silicone joint sealant.

3) Provide expansion joint filler strips, with elastomeric sealer, between p.c.c. walk and curb, p.c.c. walk and buildings, & p.c.c. walk and retaining walls and at locations noted on the construction documents. The depth of the filler strip shall be the depth of the p.c.c. walk plus 1 inch with the top set flush with the specified grade of the top of curb or walk.

Q. Protection: In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control film. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

3.03 LIGHT STANDARD BASES, FLAGPOLE BASES, POST BASES AND SIMILAR SITE STRUCTURES

A. Forms: Suitable material and type, size, shape, quality and strength to insure construction as designed, true to line and sufficiently rigid to resist deflection during placing of concrete. Clean forms of all dirt, mortar and foreign matter before use.

B. Reinforcement: Place accurately and hold in position, using metal chairs, spacers, metal hangers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of mortar, oil, dirt, loose mill scale loose or thick rust and coatings.

C. Coordinate installation of conduits, cast in place items and other inserts.

D. Finish: Grind or sack as required as determined by the Architect to produce a smooth, straight, plumb and acceptable finish without burrs or form marks. For horizontal surfaces: provide float finish.

E. Curing: Cure surfaces utilizing one of the following methods:

1. Spraying: Spray water over slab areas and maintain wet for 7 days.

2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.

3. Apply liquid curing compound at rate of 200 square feet per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units or finish of any kind.

3.04 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be high speed power vibrators (8000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.

B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.05 CURING

A. Comply with 2016 California Building Code, Title 24, Part 2, Volume 2, Section 1905A.11.

1. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by curing as herein specified.

1. Provide moisture-curing by the following methods:

a. Keep concrete surface continuously wet by covering with water.

b. Continuous water-fog spray.

c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.

2. Provide curing and sealing compound to exposed exterior slabs, walks, and curbs, as follows:

a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid, floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

C. Concrete slabs and paving shall be properly cured and protected against damage and defacement of nature during construction operations. If weather is hot or surface has dried out, spray surface with fine mist of water starting not later than two hours after final troweling. Surface of finish shall be kept continuously wet for at least ten days. Wetting is considered emergency work and shall be performed on weekends and holidays if necessary.

D. Concrete Sealer Application: Apply specified concrete sealer in continuous operation in accordance with manufacturer's instructions and recommendations.

1. Prior to starting application, protect adjoining Work, including sealant bond surfaces, from spillage or blow-over of concrete sealer.

a. Cover adjoining and nearby surfaces of aluminum and glass where there is the possibility of the concrete sealer being deposited on surfaces.

b. Cover live plants and grass.

c. Immediately clean concrete sealer from adjoining surfaces, complying with manufacturer's cleaning recommendations.

2. Apply concrete sealer under temperature conditions according to manufacturer's instructions.

3. Apply concrete sealer in light, even coats using garden sprayer, airless sprayer or paint brush.

4. Apply concrete sealer at rate to suit porosity of portland cement concrete but not less than no more than coverage rates recommended by manufacturer for effective sealing of surface.

E. The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior

to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense. Exclude traffic from concrete paving for at least 7 days after placement.

F. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

3.06 PUMPING OF CONCRETE

A. General: If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment: The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the site during pumping.

C. The minimum diameter of the hose (conduits) shall be 4-inches.

D. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced.

E. Aluminum conduits for conveying the concrete will not be permitted.

F. Proportioning: Minimum compressive strength, cement content, and maximum size of aggregates shall be as specified herein.

G. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible.

H. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.

I. Water and slump requirements shall conform to the requirements of this Section.

J. Cement and admixtures shall conform to the requirements of this Section.

K. Field Control: Concrete samples for slump per ASTM C 143 and test cylinders per ASTM C 31 and C 39.

3.07 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the ENGINEER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced.

1. All repairs and replacements herein specified shall be promptly executed by the CONTRACTOR at its own expense.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or

cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair purposes shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with non-shrink grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with non-shrink grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

E. Prior to filling any structure with water, all cracks that may have developed shall be repaired to the satisfaction of the ENGINEER. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired as specified herein.

F. The finished surface shall be free from humps, sags, blemishes or other irregularities.

3.08 FIELD QUALITY CONTROL

A. Correction of Mix Design for Failed Concrete Tests: If the compressive cylinder strength test for in place PCC yields test results below the specified 28-day PCC compressive strength and the Engineer determines a corrective change is necessary, the Contractor shall, at its own expense, make corrective changes in the mix proportions. The Engineer shall approve the changes in the mix proportions or PCC placement procedures, before any additional PCC is placed on the job.

B. Flood Tests: Before final acceptance, and after concrete has thoroughly cured, all concrete pavement, including swales and curb & gutter, shall be water tested to ensure proper drainage as directed by the Inspector. The Contractor shall provide water for this purpose. The flooding shall be done by water tank truck. Concrete work where water ponds and does not run off in a reasonable amount of time (1-hour), shall be removed to the nearest score or joint line and replaced to provide proper drainage. Full compensation for complying with this requirement shall be considered as included in the Contract Unit Price for cement concrete pavement.

3.09 CARE AND REPAIR OF CONCRETE

A. General: The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the

Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense.

B. The contractor shall barricade and protect placed Portland Cement Concrete from all damage, marks, mars and/or graffiti. Any Portland Cement Concrete damaged, defaced, discolored or defective shall be replaced at the contractor's expense.

END OF SECTION

SECTION 02820

CHAIN-LINK FENCE AND GATES

PART 1 – GENERAL

1.01 GATE ACCESSIBILITY

A. Gates shall meet all applicable specifications for doors per 2022 CBC, Section 11B-404.

1.02 SECTION INCLUDES

A. Perimeter chain-link fence as indicated on the Drawings, complete.

1.03 SUBMITTALS

A. General: Refer to Section 01300.

B. Shop Drawings: Submit fabrication details of fence accessories, including heavy-duty hardware, stops and keepers for swing gates.

C. Product Data: Submit manufacturer's literature on physical characteristics and performance of fence and gates as indicated on the Drawings.

D. Certification: Submit manufacturer's certification that fence and gates meet the requirements of this Section.

1.04 QUALITY ASSURANCE

A. Manufacturer of fencing materials shall be certified CLFMI member, and installation shall be in accordance with CLFMI standards.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original protective packaging, with manufacturer's labels and nomenclatures legible and intact.

B. Handle and store materials accordingly, to prevent soiling and physical damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fabric: 9-gage steel wire zinc-coated in accordance with ASTM A392 and woven in 1-inch diamond mesh (unless noted otherwise due to site conditions); top and bottom selvages shall be knuckled. Fabric width shall be one-piece.

B. Fence Posts: Schedule 40 pipe hot dipped galvanized to conform to ASTM F1083.

C. Schedule of Posts, Rails, Bracings and Footings: Unless indicated otherwise on the drawings, shall be of sizes indicated on the following schedule.

Item	Height	Nominal Pipe Size (inches)	Outside Diameter (inches)	Weight (pounds per foot)	Footings	
					Diameter (inches)	Depth (inches)
Top Rail, Brace Rails and Transom Rails	Up to 10’-0”	1-5/8	1.660	2.27	N/A	N/A
	10’-1” to 16’-0”	1-7/8	1.900	2.72	N/A	N/A
Line Posts	Up to 6’-0”	2-3/8	2.375	3.65	12	24
	6’-1” to 8’-0”	2-3/8	2.375	3.65	12	36
	8’-1” to 10’-0”	2-7/8	2.875	5.80	12	36
	10’-0” to 16’-0”	3-1/2	3.5	7.58	14	60
Terminal, Corner, Angle & Pull Posts	Up to 8’-0”	2-1/2	2.875	5.79	12	36
	8’-0” to 10’-0”	2-1/2	2.875	5.79	14	42
	10’-1” to 16’-0”	3	3.5	7.58	14	60
Service Gate Posts	Up to 8’-0”	2-1/2	2.875	5.79	14	36
Gate Frames	Up to 8’-0”	1-1/2	1.900	2.72	N/A	N/A
Driveway Double-Leaf Swing Gate Posts: Opening						
Up to17'-3-1/2"	Up to 8’-0”	3 1/2	4	9.11	16	42
17'-4" to 20'-3-1/2"	Up to 8’-0”	3-1/2	4	9.11	16	42

D. Top Rails: Schedule 40 pipe.

E. Gates:

1. Gate frames shall be schedule 40 pipe with 1.9 inches OD nominal size, and weighing 2.72 lbs. /ft.

2. Gate leaves shall have either; intermediate members and diagonal truss rods, or shall have tubular members providing rigid construction to swing the full width of opening, in the direction shown on the Drawings, free of sag or twist. Gate fabric shall be the same as fence fabric, except that edges shall be salvaged, and shall be attached to the gate frame by manufacturer's standard method.

3. Double gates shall consist of pairs of equal width leaves, swinging in the direction shown on the Drawings, of total width to fit indicated openings.

4. Provide regular PVT (Privacy Vertical Tubing) slats inserts on the West Fence between Building A and Building B. Provided by Academy Fence, Orange NJ., Or equal. Color to be selected by Architect.

5. Gates in path of travel must comply with exit door requirements.

(CBC Section 11B-206.5 / ADAAG 404.2.7) Hardware shall not require pinching, grasping, or twisting motion to operate. Solid kick plates, 10" minimum high shall be provided. Clear space below gate shall be 3" maximum above paving on both sides of the gate. The maximum effort to operate the gates shall not exceed 5 lbs. (22.2 N).

F. Hardware:

1. Hinges: Galvanized malleable iron to suit gate size, non-lift- off type, offset to permit 180-degree gate swing.

2. Latches: Fork or plunger-bar type, permitting operation from either side of gate. Padlock eye shall be an integral part of the latch.

3. Keepers: Mechanical devices, for holding gates leaves open until manual released, shall be provided for all gates.

4. Gate stops: Mushroom type or flush plate with anchors, set in concrete, for engaging the center-drop rod of double gate.

G. Accessories:

1. Tie wires: ASTM A 112, Class C 6-gage steel wire. Tension wire shall have a minimum tensile strength of 80,000 psi.

2. Reinforcements

a. Post braces shall be provided for each terminal, corner, pull and gate post.

b. Truss rods shall have zinc-coated turnbuckles for adjustment.

H. Concrete for Post Foundations:

1. Ingredients:

a. Portland cement: ASTM C 150, Type II.

b. Aggregate: ASTM C 33, Size 57 (1 inch maximum).

c. Water: Clear and potable.

2. Concrete mix:

a. Preparation: ASTM C 94.

b. Compressive strength: 2,500 psi at 28 days.

I. Windscreen by www.Fence-Material.com

1. Not Used

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

3.02 PREPARATION

A. Measure and lay out complete fence line, parallel to surface of ground.

B. Locate and mark position of line posts at equal spacing, not exceeding 10-foot centers. Locate corner posts at positions where fence changes direction.

3.03 INSTALLATION

A. General: Install chain-link fence in accordance with the fence manufacturer's instructions and recommendations.

B. Posts:

1. Construct post foundations as follows:

a. Diameter shall be minimum of 3 times post diameter.

b. Depth shall be a minimum of 6 inches greater than post embedment, to a total of 42 inches deep.

c. Spacing shall be a maximum of 10 feet on centers.

2. After posts have been set in concrete, do not install fence fabric until concrete has attained a maximum of 50% of design strength.

3. Existing fence posts to remain as shown on Drawings.

C. Fence Fabrics:

1. Stretch fabric tight between terminal posts and attach with tension bars threaded through fabric and tension band spaced at a maximum of 15 inches.

2. Attach fabric to line posts with tie wire at 1.0 foot on centers.

3. Attach top edge of fabric to top rail with tie wire at 2.0 feet on centers.

4. Attach bottom edge to bottom tension wire with tie wire at 2.0 feet on centers.

D. Gates: Install gates plumb and square, with ground items set in concrete. Adjust hardware to provide smooth operation.

3.04 ADJUSTING

A. Adjust brace rails and tension rods for rigid installation.

END OF SECTION

RACHLIN
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