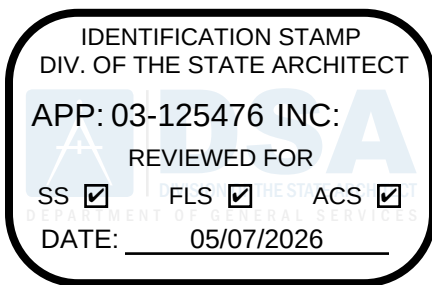


PROJECT SPECIFICATIONS

PACKAGE 5 NEW NORTH BUILDINGS

DSA File No. 19-51 DSA A# 03-125476

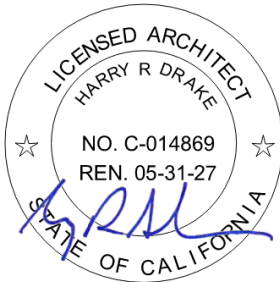
PARADISE CANYON ELEMENTARY SCHOOL
471 Knight Way
La Cañada Flintridge, CA 91011



Prepared by:
Practice Architects

For:
LA CAÑADA UNIFIED SCHOOL DISTRICT

08/05/2025



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SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Access Conditions and Requirements;
- B. General Requirement in Division 1 Sections of the Specifications
- C. Special Conditions.

1.02 SUMMARY OF WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this Contract consists of the following:

Construction of new one-story modular classroom buildings and associated site work including site utilities, retaining walls, stairs, ramps, fencing, landscaping, and hardscaping.

1.03 CONTRACTS

- A. Perform the Work under a single, fixed-price Contract under Bid No. LCF _____.

1.04 WORK BY OTHERS

- A. Work on the Project that will be performed and completed prior to the start of the Work of this Contract:

(1) NONE

- B. Work on the Project that will be performed by others concurrent with the Work of this Contract:

(1) NONE

1.05 CODES, REGULATIONS, AND STANDARDS

- A. The codes, regulations, and standards adopted by the state and federal agencies having jurisdiction shall govern minimum requirements for this Project. Where codes, regulations, and standards conflict with the Contract Documents, these conflicts shall be brought to the immediate attention of the District and the Architect.
- B. Codes, regulations, and standards shall be as published effective as of date of bid opening, unless otherwise specified or indicated.

1.06 PROJECT RECORD DOCUMENTS

- A. Contractor shall maintain on Site one set of the following record documents; Contractor shall record actual revisions to the Work:

- (1) Contract Drawings.
 - (2) Specifications.
 - (3) Addenda.
 - (4) Change Orders and other modifications to the Contract.
 - (5) Reviewed shop drawings, product data, and samples.
 - (6) Field test records.
 - (7) Inspection certificates.
 - (8) Manufacturer's certificates.
- B. Contractor shall store Record Documents separate from documents used for construction. Provide files, racks, and secure storage for Record Documents and samples.
- C. Contractor shall record information concurrent with construction progress.
- D. Specifications: Contractor shall legibly mark and record at each product section of the Specifications the description of the actual product(s) installed, including the following:
- (1) Manufacturer's name and product model and number.
 - (2) Product substitutions or alternates utilized.
 - (3) Changes made by Addenda and Change Orders and written directives.

1.07 EXAMINATION OF EXISTING CONDITIONS

- A. Contractor shall be held to have examined the Project Site and acquainted itself with the conditions of the Site and of the streets or roads approaching the Site.
- B. Prior to commencement of Work, Contractor shall survey the Site and existing buildings and improvements to observe existing damage and defects such as cracks, sags, broken, missing or damaged glazing, other building elements and Site improvements, and other damage.
- C. Should Contractor observe cracks, sags, and other damage to and defects of the Site and adjacent buildings, paving, and other items not indicated in the Contract Documents, Contractor shall immediately report same to the District and the Architect.

1.08 CONTRACTOR'S USE OF PREMISES

- A. School facilities are not available to Contractor for use.
- B. If the space at the Project Site is not sufficient for Contractor's operations, storage, office facilities and/or parking, Contractor shall arrange and pay for any additional facilities needed by Contractor.
- C. Contractor shall not interfere with use of or access to occupied portions of the building(s) or adjacent property.

- D. Contractor shall maintain walkways to be used by school staff during the course of construction clear and free of debris and obstructions at all times.
- E. No one other than those directly involved in the demolition and construction, or specifically designated by the District or the Architect shall be permitted in the areas of work during demolition and construction activities.
- F. The Contractor shall install the construction fence and maintain that it will be locked when not in use. Keys to this fencing will be provided to the District.
- G. No work will be permitted to start prior to 7:00am.

1.09 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. The Drawings show above-grade and below-grade structures, utility lines, and other installations that are known or believed to exist in the area of the Work. Contractor shall locate these existing installations before proceeding with excavation and other operations that could damage same; maintain them in service, where appropriate; and repair damage to them caused by the performance of the Work. Should damage occur to these existing installations, the costs of repair shall be at the Contractor's expense and made to the District's satisfaction.
- B. Contractor shall be alert to the possibility of the existence of additional structures and utilities. If Contractor encounters additional structures and utilities, Contractor will immediately report to the District for disposition of same as indicated in the General Conditions.

1.10 UTILITY SHUTDOWNS AND INTERRUPTIONS

- A. Contractor shall give the District a minimum of five (5) days written notice in advance of any need to shut off existing utility services or to effect equipment interruptions. The District will set exact time and duration for shutdown, and will assist Contractor with shutdown. Work required to re-establish utility services shall be performed by the Contractor. **NO SHUTDOWN OF UTILITIES SHALL OCCUR WHEN SCHOOL IS IN SESSION.**
- B. Contractor shall obtain District's written approval as indicated in the General Conditions in advance of deliveries of material or equipment or other activities that may conflict with District's use of the building(s) or adjacent facilities.

1.11 STRUCTURAL INTEGRITY

- A. Contractor shall be responsible for and supervise each operation and work that could affect structural integrity of various building elements, both permanent and temporary.
- B. Contractor shall include structural connections and fastenings as indicated or required for complete performance of the Work.

PART 2 – PRODUCTS Not Used.

PART 3 – EXECUTION Not Used.

END OF DOCUMENT

DOCUMENT 01 21 00

ALLOWANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-specified work.

1.2 RELATED SECTIONS

A. Document 01 10 00 Summary of Work

B. Document 01 29 00 Application for Payment Release Forms

C. Document 01 33 00 Submittals

1.3 ALLOWANCES

A. Included in the Contract, a stipulated sum/price of Four Hundred Thousand dollars (\$400,000) as an allowance for Unforeseen Conditions within the limits set forth in the Documents. This Allowance shall not be utilized without written approval by the District. Allowance to be used only at the District's discretion.

B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding and equipment rental will be included in Allowance Expenditure Directive authorizing expenditure of funds from this Allowance.

C. Funds will be drawn from Allowance only with District approval evidenced by an Allowance Expenditure Directive.

D. At Contract closeout, funds remaining in Allowance will be credited to District by Change Order.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF DOCUMENT

ALTERNATES AND UNIT PRICING

PART 1 – ALTERNATES

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A.** General Conditions;
- B.** Special Conditions;
- C.** Bid Form and Proposal;
- D.** Instruction to Bidders.

1.02 DESCRIPTION

The items of work indicated below propose modifications to, substitutions for, additions to and/or deletions from the various parts of the Work specified in other Sections of the Specifications. The acceptance or rejection of any of the alternates is strictly at the option of the District subject to District's acceptance of Contractor's stated prices contained in this Proposal.

1.03 GENERAL

Where an item is omitted, or scope of Work is decreased, all Work pertaining to the item whether specifically stated or not, shall be omitted and where an item is added or modified or where scope of Work is increased, all Work pertaining to that required to render same ready for use on the Project in accordance with intention of Drawings and Specifications shall be included in an agreed upon price amount.

1.04 BASE BID

The Base Bid includes all work required to construct the Project completely and in accordance with the Contract Documents.

1.05 ALTERNATES

- A.** NONE

The above Alternate descriptions are general in nature and for reference purposes only. The Contract Documents, including, without limitation, the Drawings and Specifications, must be referred to for the complete scope of Work.

PART 2 - UNIT PRICING

2.01 GENERAL

Contractor shall completely state all required figures based on Unit Prices listed below. Where scope of Work is decreased, all Work pertaining to the item, whether specifically stated or not, shall be omitted and where scope of Work is increased, all work pertaining to that item required to render same ready for use on

the Project in accordance with intention of Drawings and Specifications shall be included in an agreed upon price amount.

2.02 UNIT PRICES

Furnish unit prices for each of the named items on a square foot, lineal foot, or per each basis, as applies. Unit prices shall include all labor, materials, services, profit, overhead, insurance, bonds, taxes, and all other incidental costs of Contractor, subcontractors, and supplier(s).

END OF DOCUMENT

PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. Instructions to Bidders;
- B. General Conditions, including, without limitation, Substitutions for Specified Items; and
- C. Special Conditions.

1.02 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

- A. Catalog numbers and specific brands or trade names followed by the designation "or equal" are used in conjunction with material and equipment required by the Specifications to establish the standards of quality, utility, and appearance required. Substitutions which are equal in quality, utility, and appearance to those specified may be reviewed subject to the provisions of the General Conditions.
- B. Wherever more than one manufacturer's product is specified, the first-named product is the basis for the design used in the work and the use of alternative-named manufacturers' products or substitutes may require modifications in that design. If such alternatives are proposed by Contractor and are approved by the District and/or the Architect, Contractor shall assume all costs required to make necessary revisions and modifications of the design resulting from the substitutions requested by the Contractor.
- C. When materials and equipment are specified by first manufacturer's name and product number, second manufacturer's name and "or approved equal," supporting data for the second product, if proposed by Contractor, shall be submitted in accordance with the requirements for substitutions. The District's Board has found and determined that certain item(s) shall be used on this Project based on the purpose(s) indicated pursuant to Public Contract Code section 3400(c). These findings, as well as the products and brand or trade names, have been identified in the Notice to Bidders.
- D. The Contractor will not be allowed to substitute specified items unless the request for substitution is submitted as follows:
 - (1) District must receive any notice of request for substitution of a specified item a minimum of ten (10) calendar days prior to bid opening.
 - (2) Within 35 days after the date of the Notice of Award, the Contractor shall submit data substantiating the request(s) for all substitution(s) containing sufficient information to assess acceptability of product or system and impact on Project, including, without limitation, the requirements specified in the Special Conditions and the technical Specifications. Insufficient information shall be grounds for rejection of substitution.
- E. If the District and/or Architect, in reviewing proposed substitute materials and equipment, require revisions or corrections to be made to previously accepted Shop Drawings and supplemental

supporting data to be resubmitted, Contractor shall promptly do so. If any proposed substitution is judged by the District and/or Architect to be unacceptable, the specified material or equipment shall be provided.

- F. Samples may be required. Tests required by the District and/or Architect for the determination of quality and utility shall be made at the expense of Contractor, with acceptance of the test procedure first given by the District.
- G. In reviewing the supporting data submitted for substitutions, the District and/or Architect will use for purposes of comparison all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Contract Documents. If more than two (2) submissions of supporting data are required, the cost of reviewing the additional supporting data shall be borne by Contractor, and the District will deduct the costs from the Contract Price. The Contractor shall be responsible for any re-design costs occasioned by District's acceptance and/or approval of any substitute.
- H. The Contractor shall, in the event that a substitute is less costly than that specified, credit the District with one hundred percent (100%) of the net difference between the substitute and the originally specified material. In this event, the Contractor agrees to execute a deductive Change Order to reflect that credit. In the event Contractor furnishes a material, process, or article more expensive than that specified, the difference in the cost of that material, process, or article so furnished shall be borne by Contractor.
- I. In no event shall the District be liable for any increase in Contract Price or Contract Time due to any claimed delay in the evaluation of any proposed substitute or in the acceptance or rejection of any proposed substitute.

PART 2 – PRODUCTS Not Used.

PART 3 – EXECUTION Not Used.

END OF DOCUMENT

DOCUMENT 01 26 00

CHANGES IN THE WORK

CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE PROVISIONS IN THE AGREEMENT, GENERAL CONDITIONS, AND SPECIAL CONDITIONS, IF USED, RELATED TO CHANGES AND/OR REQUESTS FOR CHANGES.

END OF DOCUMENT

DOCUMENT 01 29 00

APPLICATION FOR PAYMENT AND
CONDITIONAL AND UNCONDITIONAL WAIVER AND RELEASE FORMS

CONTRACTOR SHALL COMPLY WITH ALL PROVISIONS IN THE GENERAL CONDITIONS RELATED TO APPLICATIONS FOR PAYMENT AND/OR PAYMENTS.

CONDITIONAL WAIVER AND RELEASE
ON PROGRESS PAYMENT
(CIVIL CODE SECTION 8132)

NOTICE: THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Name of Claimant: _____

Name of Customer: _____

Job Location: _____

Owner: _____

Through Date: _____

Conditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check: _____

Amount of Check: \$ _____

Check Payable to: _____

Exceptions

This document does not affect any of the following:

- (1) Retentions.
- (2) Extras for which the claimant has not received payment.
- (3) The following progress payments for which the claimant has previously given a conditional waiver and release but has not received payment:

Date(s) of waiver and release: _____

Amount(s) of unpaid progress payment(s): \$ _____

- (4) Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Claimant's Signature: _____

PARADISE CANYON ELEMENTARY SCHOOL
PACKAGE 5 – NEW NORTH BUILDINGS

5/15/2023
APPLICATION FOR PAYMENT AND
CONDITIONAL AND UNCONDITIONAL WAIVER AND
RELEASE FORMS
DOCUMENT 01 29 00-2

Claimant's Title: _____

Date of Signature: _____

UNCONDITIONAL WAIVER AND RELEASE
ON PROGRESS PAYMENT
(CIVIL CODE SECTION 8134)

NOTICE TO CLAIMANT: THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Name of Claimant: _____

Name of Customer: _____

Job Location: _____

Owner: _____

Through Date: _____

Unconditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has received the following progress payment: \$_____

Exceptions

This document does not affect any of the following:

- (1) Retentions.
- (2) Extras for which the claimant has not received payment.
- (3) Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Claimant's Signature: _____

Claimant's Title: _____

Date of Signature: _____

CONDITIONAL WAIVER AND RELEASE
ON FINAL PAYMENT
(CIVIL CODE SECTION 8136)

NOTICE: THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Name of Claimant: _____

Name of Customer: _____

Job Location: _____

Owner: _____

Conditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check:

Amount of Check: \$ _____

Check Payable to: _____

Exceptions

This document does not affect any of the following: _____

Disputed claims for extras in the amount of: \$ _____

Claimant's Signature: _____

Claimant's Title: _____

Date of Signature: _____

UNCONDITIONAL WAIVER AND RELEASE
ON FINAL PAYMENT
(CIVIL CODE SECTION 8138)

NOTICE TO CLAIMANT: THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Name of Claimant: _____

Name of Customer: _____

Job Location: _____

Owner: _____

Unconditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for all labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has been paid in full.

Exceptions

This document does not affect any of the following: _____

Disputed claims for extras in the amount of: \$ _____

Claimant's Signature: _____

Claimant's Title: _____

Date of Signature: _____

PROJECT MEETINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions; and
- B. Special Conditions.

1.02 PROGRESS MEETINGS:

- A. Contractor shall schedule and hold regular weekly progress meetings after a minimum of one week's prior written notice of the meeting date and time to all Invitees as indicated below.
- B. Location: Contractor's field office.
- C. The Contractor shall notify and invite the following entities ("Invitees"):
 - (1) District Representative.
 - (2) Contractor.
 - (3) Contractor's Project Manager.
 - (4) Contractor's Superintendent.
 - (5) Subcontractors, as appropriate to the agenda of the meeting.
 - (6) Suppliers, as appropriate to the agenda of the meeting.
 - (7) Construction Manager, if any.
 - (8) Architect
 - (9) Engineer(s), if any and as appropriate to the agenda of the meeting.
 - (10) Others, as appropriate to the agenda of the meeting.
- D. The District's and/or the Architect's Consultants will attend at their discretion, in response to the agenda.
- E. The District representative, the Construction Manager, and/or another District Agent shall take and distribute meeting notes to attendees and other concerned parties. If exceptions are taken to anything in the meeting notes, those exceptions shall be stated in writing to the District within five (5) working days following District's distribution of the meeting notes.

1.03 PRE-INSTALLATION/PERFORMANCE MEETING:

- A. Contractor shall schedule a meeting prior to the start of each of the following portions of the Work: cutting and patching of plaster and roofing, and other weather-exposed and moisture-resistant products. Contractor shall invite all Invitees to this meeting, and others whose work may affect or be affected by the quality of the cutting and patching work.
- B. Contractor shall review in detail prior to this meeting, the manufacturer's requirements and specifications, applicable portions of the Contract Documents, Shop Drawings, and other submittals, and other related work. At this meeting, invitees shall review and resolve conflicts, incompatibilities, or inadequacies discovered or anticipated.
- C. Contractor shall review in detail Project conditions, schedule, requirements for performance, application, installation, and quality of completed Work, and protection of adjacent Work and property.
- D. Contractor shall review in detail means of protecting the completed Work during the remainder of the construction period.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

END OF DOCUMENT

SCHEDULING OF WORK

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Construction Schedule procedures, preparation, submittal, updates, and revisions.

1.02 RELATED REQUIREMENTS

- A. Master Facilities Lease.
- B. Section 01 11 00: Summary of Work.
- C. Section 01 12 16: Phasing of the Work.
- D. Section 01 29 73: Schedule of Values Procedures.
- E. Section 01 29 76: Progress Payment Procedures.
- F. Section 01 31 13: Project Coordination.
- G. Section 01 33 00: Submittal Procedures.
- H. Section 01 45 23: Testing and Inspection.
- I. Section 01 50 00: Construction Facilities and Temporary Controls.
- J. Section 01 78 36: Warranty Procedures.

1.03 PROCEDURES

- A. Within seven (7) calendar days after date of Notice to Proceed, Contractor shall submit to District Representative for review, a detailed Construction Schedule (“Preliminary Baseline Schedule”) setting forth all requirements for complete execution of the Work.
- B. Within three (3) calendar days after receipt of the District Representative’s review comments, submit a final Construction Schedule acceptable to District Representative (“Approved Baseline Schedule”).
- C. Include a written summary narrative sufficiently comprehensive to explain basis of Contractor’s approach to work.
- D. If a Construction Schedule is considered by District Representative to not be in compliance with any requirement of the Contract, Contractor will be notified to review and revise the Construction Schedule and bring it into compliance. Failure of Contractor to submit a Construction Schedule in full compliance with the Contract Documents will result in withholding of progress payment in accordance with the General Conditions or Construction Services Agreement. The Construction Schedule is to be used in evaluating progress for payment approval.
- E. Subsequently with each Progress Payment Request, Contractor shall deliver to District Representative an updated Construction Schedule reflecting Work progress to the end of the Progress Payment Request period. Each such Construction Schedule shall indicate actual progress to date in execution of the Work, together with a projected schedule for completion of all the Work.

1.04 SCHEDULE SUBMITTAL PREPARATION GUIDELINES

- A. The Contract Work shall be scheduled and progress monitored using a Critical Path Method (CPM) network type scheduling system. Schedule shall be broken into sub-activities which shall, as a minimum, include all submittal approvals, all major trades, mobilization, temporary fencing, temporary utilities, hazardous material abatement, demolition work. Scheduling system shall indicate all inter-relationships between construction activities.

- B. Contractor shall utilize the Critical Path Method (CPM) in the development and maintenance of the construction schedule network.
- C. Duration and events indicated on schedule shall conform to phasing set forth in Special Conditions: Phasing of the Work and shall show any area or building within a particular phase. Schedule shall indicate any and all Contract "milestone events" and other milestones agreed to by District Representative, but no other manually-imposed dates will be accepted unless approved by District Representative.
- D. Construction Schedule shall represent a practical plan to complete the Work within the Contract time requirement.
 - 1. A schedule extending beyond Contract time or less than Contract time will not be acceptable.
 - 2. A schedule found unacceptable by District Representative shall be revised by Contractor and resubmitted.
- E. Construction schedule shall clearly indicate sequence of construction activities, grouped by applicable phase and sorted by areas, buildings, or facilities within phase, and shall specifically indicate:
 - 1. Start and completion of all Work items, their major components, and interim milestone completion dates, as determined by Contractor and District Representative.
 - 2. Activities for procurement, delivery, installation of equipment, materials, and other supplies, including:
 - a. Time for submittals, resubmittals, and reviews. Include decision dates for selection of finishes.
 - b. Time for manufactured products for the Work fabrication and delivery.
 - c. Interdependence of procurement and construction activities.
 - d. As applicable, dates for testing, balancing equipment, and final inspection.
- F. Schedule shall be in sufficient detail to assure adequate planning and execution of the Work.
 - 1. Each task activity shall range in duration from a 1 workday minimum to a ten (10) workday maximum and shall be total of actual days required for completion. The activity duration shall include consideration of weather impact on completion of that activity.
 - 2. Schedule shall be suitable, in judgment of District Representative, to allow monitoring and evaluation of progress in performance of the Work; it shall be calendar time-scaled.
 - 3. Activities shall include:
 - a. Description; what is to be accomplished and where.
 - b. Workday duration.
 - c. Scheduled activities shall indicate continuous flow, from left to right.
 - 4. Contractor shall setup up the schedule calendar to identify workdays per week and shifts per day worked, non-work days, weekends and holidays.
- G. Failure to include any element of Work required for performance of this Contract shall not excuse Contractor from completing Work required to comply with the Contract Documents, notwithstanding acceptance of Construction Schedule.
- H. Submittal of Construction Schedule shall be understood to be Contractor's confirmation that the schedule meets requirements of the Contract Documents, and that the Work will be executed in sequence indicated in schedule.

- I. All Construction Schedule submittals shall be transmitted with a Letter of Transmittal and shall include three (3) copies and one reproducible copy of a sufficient agreed upon size and the electronic file of the schedule in the format as required by District Representative.

1.05 REVIEWS, UPDATES, AND REVISIONS

- A. District Representative will review and return the initial submittal of Contractor's Construction Schedule, with summary comments. If revisions are required, Contractor shall resubmit Schedule within three (3) calendar days following receipt of District Representative's comments.
- B. After Contractor and District Representative agree to a baseline schedule, it will become the Project Construction Schedule (Approved Baseline Schedule). No changes to the Baseline Schedule will be allowed unless approved by District Representative in writing.
- C. Contractor shall analyze and update the Project Construction Schedule:
 - 1. As part of monthly payment application, Contractor shall submit to and participate with District Representative in a schedule review to include:
 - a. Actual start dates for Work items started during report period.
 - b. The percent complete on activities that have actual start dates.
 - c. Actual completion dates for Work items completed during report period.
 - d. Estimated remaining duration for Work items in progress, which will not exceed original duration for activity.
 - e. Estimated start dates for Work items scheduled to start during month following report period, if applicable.
 - f. Changes in duration of Work items.
 - 2. In case of a change to Contractor's planned sequence of Work, Contractor shall include a narrative report with updated progress schedule which shall include, but not be limited to, a description of problem areas, current and anticipated delaying factors, and any proposed revisions for a recovery plan.
 - 3. Change Orders affecting the scheduled completion date shall be clearly identified as separate and new activities integrated into the schedule at the appropriate time and in the appropriate sequence as reviewed and approved by District Representative.
 - 4. The Project Construction Schedule Review will not relieve Contractor of responsibility for accomplishing all Work in accordance with the Contract Documents.
- D. Updates: Contractor shall submit to District Representative, with each payment application, an up-to-date Project Construction Schedule. Contractor submission of the Monthly Updated Project Construction Schedule is a condition precedent to District Representative's approval of Progress Payments. The Update Project Construction Schedule shall include the following:
 - 1. Work Item Report: Detailing Work items and dependencies as indicated on the Schedule.
 - 2. Actual Start and End Dates of Activities under construction
 - 3. Separate listing of activities completed during reporting period.
 - 4. Separate listing of activities which are currently in progress, indicating their remaining duration and percentages completed.
 - 5. Separate listing of activities which are causing delay in Work progress.
 - 6. Narrative report to define problem areas, anticipated delays, and impact on the Project Construction Schedule. Contractor shall report corrective action taken, or proposed, and its effect, including effect of changes on schedules of separate contractors.

7. Resolution of conflict between actual Work progress and schedule logic: when out-of-sequence activities develop in the Schedule because of actual construction progress, Contractor shall submit a revised schedule to conform to current job sequence and direction.
- E. If, according to current updated Project Construction Schedule, District Representative determines Contractor is behind schedule or any interim milestone completion dates will not be met, considering all time extensions to which Contractor is entitled, Contractor shall submit a revised construction schedule, or recovery schedule, showing a workable plan and a narrative description to complete the project on time. Refer to General Conditions.
- F. Scheduling of change or extra Work orders is responsibility of Contractor.
 1. Contractor shall revise the Project Construction Schedule to incorporate all activities involved in completing change orders or extra Work orders and submit it to District Representative for review.
- G. If District Representative finds Contractor is entitled to extension of any completion date, under provisions of the Contract, District Representative's determination of total number of days of extension will be based upon an analysis of the current Project Construction Schedule, and upon data relevant to the extension.
- H. Contractor acknowledges and agrees that delays to non-critical activities will not be considered a basis for a time extension unless activities become critical. Non-critical activities are those activities which, when delayed, do not affect an interim or Substantial Completion date.
- I. Contractor shall allow Float time for inclement weather, Government Delay, and Project Float in the Baseline Schedule in accordance with the General Conditions. The Inclement Weather Float and the Government Delay Float shall each be identified as a Critical Activity in the Baseline Schedule. No other activities may be concurrent with them. When rainfall at the Project site impacts Critical Path activities, Contractor may provide District Representative 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 seventy-five percent (75%) decrease in the normal field labor workforce hours on Critical Path activities on the day in question as indicated by Contractor's Daily reports from the day in question and the scheduled Work days prior to the day in question. Upon District Representative's independent confirmation of the amount of rainfall and impact, District Representative 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.

1.06 CONTRACTOR'S RESPONSIBILITY

- A. Nothing in these requirements shall be deemed to be an usurpation of Contractor's authority and responsibility to plan and schedule Work as Contractor sees fit, subject to all other requirements of Contract Documents.
- B. Contractor shall provide at all times sufficient competent labor, materials, and equipment to properly carry on Work and to ensure completion of each part in accordance with Construction Schedule and within time allowed in the Contract.
- C. Contractor shall be responsible for ensuring that all submittals to the District Representative are accurate and consistent. Damage, including extra time and cost, caused by inaccuracies from Contractor will be compensated by Contractor.

1.07 SUSPENSION OF PAYMENTS

- A. Initial Submittal: If Contractor fails to comply with the specified requirements, District Representative reserves the right to engage an independent scheduling consultant to fulfill these requirements. Upon additional notice to Contractor, District Representative shall retain against Contractor all incurred costs for additional services.

- B. Update Submittals: District Representative has the right to withhold progress payments if Contractor fails to update and submit the Project Construction Schedule and reports as required by District Representative.

1.08 RECORD COPY

- A. Prior to the Contract Completion, Contractor shall submit the Project Construction Schedule showing the as-built sequence. The as-built schedule shall have all activities with actual start and end dates.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF DOCUMENT

SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Contractor's Submittals and Schedules, Drawings and Specifications;
- B. Special Conditions.

1.02 SECTION INCLUDES:

A. Definitions:

- (1) Shop Drawings and Product Data are as indicated in the General Conditions and include, but are not limited to, fabrication, erection, layout and setting drawings, formwork and falsework drawings, manufacturers' standard drawings, descriptive literature, catalogues, brochures, performance and test data, wiring and control diagrams. In addition, there are other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and methods of construction as may be required to show that the materials, equipment or systems and all positions conform to the requirement of the Contract Documents, including, without limitation, the Drawings.
- (2) "Manufactured" applies to standard units usually mass-produced; "fabricated" means specifically assembled or made out of selected materials to meet design requirements. Shop Drawings shall establish the actual detail of manufactured or fabricated items, indicated proper relation to adjoining work and amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure.
- (3) Manufacturer's Instructions: Where any item of Work is required by the Contract Documents to be furnished, installed, or performed, at a minimum, in accordance with a specified product manufacturer's instructions, the Contractor shall procure and distribute copies of these to the District, the Architect, and all other concerned parties and shall furnish, install, or perform the work, at a minimum, in accordance with those instructions.

B. Samples, Shop Drawings, Product Data, and other items as specified, in accordance with the following requirements:

- (1) Contractor shall submit all Shop Drawings, Product Data, and Samples to the District, the Architect, the Project Inspector, and the Construction Manager.
- (2) Contractor shall comply with all time frames herein and in the General Conditions and, in any case, shall submit required information in sufficient time to permit proper consideration and action before ordering any materials or items represented by such Shop Drawings, Product Data, and/or Samples.
- (3) Contractor shall allow sufficient time so that no delay occurs due to required lead time in ordering or delivery of any item to the Site. Contractor shall be responsible for any delay in progress of Work due to its failure to observe these requirements.

- (4) Time for completion of Work shall not be extended on account of Contractor's failure to promptly submit Shop Drawings, Product Data, and/or Samples.
- (5) Reference numbers on Shop Drawings shall have Architectural and/or Engineering Contract Drawings reference numbers for details, sections, and "cuts" shown on Shop Drawings. These reference numbers shall be in addition to any numbering system that Contractor chooses to use or has adopted as standard.
- (6) When the magnitude or complexity of submittal material prevents a complete review within the stated time frame, Contractor shall make this submittal in increments to avoid extended delays.
- (7) Contractor shall certify on submittals for review that submittals conform to Contract requirements. Also certify that Contractor-furnished equipment can be installed in allocated space. In event of any variance, Contractor shall specifically state in transmittal and on Shop Drawings, portions vary and require approval of a substitute. Submittals shall not be used as a means of requesting a substitution.
- (8) Unless specified otherwise, sampling, preparation of samples, and tests shall be in accordance with the latest standard of the American Society for Testing and Materials.
- (9) Upon demand by Architect or District, Contractor shall submit samples of materials and/or articles for tests or examinations and consideration before Contractor incorporates same in Work. Contractor shall be solely responsible for delays due to sample(s) not being submitted in time to allow for tests. Acceptance or rejection will be expressed in writing. Work shall be equal to approved samples in every respect. Samples that are of value after testing will remain the property of Contractor.

C. Submittal Schedule:

- (1) Contractor shall prepare its proposed submittal schedule that is coordinated with the proposed construction schedule and submit both to the District within ten (10) days after the date of the Notice to Proceed. Contractor's proposed schedules shall become the Project Construction Schedule and the Project Submittal Schedule after each is approved by the District.
- (2) Contractor is responsible for all lost time should the initial submittal be rejected, marked "revise and resubmit", etc.
- (3) All Submittals shall be forwarded to the District by the date indicated on the approved Submittal Schedule, unless an earlier date is necessary to maintain the Construction Schedule, in which case those Submittals shall be forwarded to the District so as not to delay the Construction Schedule.
- (4) Contractor may be assessed \$100 a day for each day it is late in submitting a shop drawing or sample. No extensions of time will be granted to Trade Contractor or any Subcontractor because of its failure to have shop drawings and samples submitted in accordance with the Schedule.

1.03 SHOP DRAWINGS:

- A. Contractor shall submit one reproducible transparency/ pdf file and six (6) opaque reproductions. The District will review and return the reproducible copy and one (1) opaque reproduction to Contractor.

- B. Before commencing installation of any Work, the Contractor shall submit and receive approval of all drawings, descriptive data, and material list(s) as required to accomplish Work.
- C. Review of Shop Drawings is regarded as a service to assist Contractor and in all cases original Contract Documents shall take precedence as outlined under General Conditions.
- D. No claim for extra time or payment shall be based on work shown on Shop Drawings unless the claim is (1) noted on Contractor's transmittal letter accompanying Shop Drawings and (2) Contractor has complied with all applicable provisions of the General Conditions, including, without limitation, provisions regarding changes and payment, and all required written approvals.
- E. District shall not review Shop Drawings for quantities of materials or number of items supplied.
- F. District's and/or Architect's review of Shop Drawing will be general. District and/or Architect review does not relieve Contractor of responsibility for dimensions, accuracy, proper fitting, construction of Work, furnishing of materials, or Work required by Contract Documents and not indicated on Shop Drawings. The District's and/or Architect's review of Shop Drawings is not to be construed as approving departures from Contract Documents.
- G. Review of Shop Drawings and Schedules does not relieve Contractor from responsibility for any aspect of those Drawings or Schedules that is a violation of local, County, State, or Federal laws, rules, ordinances, or rules and regulations of commissions, boards, or other authorities or utilities having jurisdiction.
- H. Before submitting Shop Drawings for review, Contractor shall check Shop Drawings of its subcontractors for accuracy, and confirm that all Work contiguous with and having bearing on other work shown on Shop Drawings is accurately drawn and in conformance with Contract Documents.
- I. Submitted drawings and details must bear stamp of approval of Contractor:
 - (1) Stamp and signature shall clearly certify that Contractor has checked Shop Drawings for compliance with Drawings.
 - (2) If Contractor submits a Shop Drawing without an executed stamp of approval, or whenever it is evident (despite stamp) that Drawings have not been checked, the District and/or Architect will not consider them and will return them to the Contractor for revision and resubmission. In that event, it will be deemed that Contractor has not complied with this provision and Contractor shall bear risk of all delays to same extent as if it had not submitted any Shop Drawings or details.
- J. Submission of Shop Drawings (in either original submission or when resubmitted with correction) constitutes evidence that Contractor has checked all information thereon and that it accepts and is willing to perform Work as shown.
- K. Contractor shall pay for cost of any changes in construction due to improper checking and coordination. Contractor shall be responsible for all additional costs, including coordination. Contractor shall be responsible for costs incurred by itself, the District, the Architect, the Project Inspector, the Construction Manager, any other Subcontractor or contractor, etc., due to improperly checked and/or coordination of submittals.
- L. Shop Drawings must clearly delineate the following information:
 - (1) Project name and address.
 - (2) Specification number and description.

- (3) Architect's name and project number.
 - (4) Shop Drawing title, number, date, and scale.
 - (5) Names of Contractor, Subcontractor(s) and fabricator.
 - (6) Working and erection dimensions.
 - (7) Arrangements and sectional views.
 - (8) Necessary details, including complete information for making connections with other Work.
 - (9) Kinds of materials and finishes.
 - (10) Descriptive names of materials and equipment, classified item numbers, and locations at which materials or equipment are to be installed in the Work. Contractor shall use same reference identification(s) as shown on Contract Drawings.
- M. Contractor shall prepare composite drawings and installation layouts when required to solve tight field conditions.
- (1) Shop Drawings shall consist of dimensioned plans and elevations and must give complete information, particularly as to size and location of sleeves, inserts, attachments, openings, conduits, ducts, boxes, structural interferences, etc.
 - (2) Contractor shall coordinate these composite Shop Drawings and installation layouts in the field between itself and its Subcontractor(s) for proper relationship to the Work, the work of other trades, and the field conditions. The Contractor shall check and approve all submittal(s) before submitting them for final review.

1.04 PRODUCT DATA OR NON REPRODUCIBLE SUBMITTALS:

- A. Contractor shall submit manufacturer's printed literature in original form. Any fading type of reproduction will not be accepted. Contractor must submit a minimum of six (6) each, to the District. District shall return one (1) to the Contractor, who shall reproduce whatever additional copies it requires for distribution.
- B. Contractor shall submit six (6) copies of a complete list of all major items of mechanical, plumbing, and electrical equipment and materials in accordance with the approved Submittal Schedule, except as required earlier to comply with the approved Construction Schedule. Other items specified are to be submitted prior to commencing Work. Contractor shall submit items of like kind at one time in a neat and orderly manner. Partial lists will not be acceptable.
- C. Submittals shall include manufacturer's specifications, physical dimensions, and ratings of all equipment. Contractor shall furnish performance curves for all pumps and fans. Where printed literature describes items in addition to that item being submitted, submitted item shall be clearly marked on sheet and superfluous information shall be crossed out. If highlighting is used, Contractor shall mark all copies.
- D. Equipment submittals shall be complete and include space requirements, weight, electrical and mechanical requirements, performance data, and supplemental information that may be requested.
- E. Imported Materials Certification must be submitted at least ten (10) days before material is delivered.

1.05 SAMPLES:

- A. Contractor shall submit for approval Samples as required and within the time frame in the Contract Documents. Materials such as concrete, mortar, etc., which require on-site testing will be obtained from Project Site.
- B. Contractor shall submit four (4) samples except where greater or lesser number is specifically required by Contract Documents including, without limitation, the Specifications.
 - (1) Samples must be of sufficient size and quality to clearly illustrate functional characteristics, with integrally related parts and attachment devices.
 - (2) Samples must show full range of texture, color, and pattern.
- C. Contractor shall make all Submittals, unless it has authorized Subcontractor(s) to submit and Contractor has notified the District in writing to this effect.
- D. Samples to be shipped prepaid or hand-delivered to the District.
- E. Contractor shall mark samples to show name of Project, name of Contractor submitting, Contract number and segment of Work where representative Sample will be used, all applicable Specifications Sections and documents, Contract Drawing Number and detail, and ASTM or FS reference, if applicable.
- F. Contractor shall not deliver any material to Site prior to receipt of District's and/or Architect's completed written review and approval. Contractor shall furnish materials equal in every respect to approved Samples and execute Work in conformance therewith.
- G. District's and/or Architect's review, acceptance, and/or approval of Sample(s) will not preclude rejections of any material upon discovery of defects in same prior to final acceptance of completed Work.
- H. After a material has been approved, no change in brand or make will be permitted.
- I. Contractor shall prepare its Submittal Schedule and submit Samples of materials requiring laboratory tests to specified laboratory for testing not less than ninety (90) days before such materials are required to be used in Work.
- J. Samples which are rejected must be resubmitted promptly after notification of rejection and be marked "Resubmitted Sample" in addition to other information required.
- K. Field Samples and Mock-Ups are to be removed by Contractor at District's direction:
 - (1) Size: As Specified.
 - (2) Furnish catalog numbers and similar data, as requested.

1.06 REVIEW AND RESUBMISSION REQUIREMENTS:

- A. The District will arrange for review of Sample(s), Shop Drawing(s), Product Data, and other submittal(s) by appropriate reviewer and return to Contractor as provided below within twenty-one (21) days after receipt or within twenty-one (21) days after receipt of all related information necessary for such review, whichever is later.
- B. One (1) copy of product or materials data will be returned to Contractor with the review status.

- C. Samples to be incorporated into the Work will be returned to Contractor, together with a written notice designating the Sample with the appropriate review status and indicating errors discovered on review, if any. Other Samples will not be returned, but the same notice will be given with respect thereto, and that notice shall be considered a return of the Sample.
- D. Contractor shall revise and resubmit any Sample(s), Shop Drawing(s), Product Data, and other submittal(s) as required by the reviewer. Such resubmittals will be reviewed and returned in the same manner as original Sample(s), Shop Drawing(s), Product Data, and other submittal(s), within fourteen (14) days after receipt thereof or within fourteen (14) days after receipt of all related information necessary for such review. Such resubmittal shall not delay the Work.
- E. Contractor may proceed with any of the Work covered by Sample(s), Shop Drawing(s), Product Data, and other submittal(s) upon its return if designated as no exception taken, or revise as noted, provided the Contractor proceeds in accordance with the District and/or the Architect's notes and comments.
- F. Contractor shall not begin any of the work covered by a Sample(s), Shop Drawing(s), Product Data, and other submittal(s), designated as revise and resubmit or rejected, until a revision or correction thereof has been reviewed and returned to Contractor.
- G. Sample(s), Shop Drawing(s), Product Data, and other submittal(s) designated as revise and resubmit or rejected and requiring resubmittal, shall be revised or corrected and resubmitted to the District no later than fourteen (14) days or a shorter period as required to comply with the approved Construction Schedule, after its return to Contractor.
- H. Neither the review nor the lack of review of any Sample(s), Shop Drawing(s), Product Data, and other submittal(s) shall waive any of the requirements of the Contract Documents, or relieve Contractor of any obligation thereunder.
- I. District's and/or Architect's review of Shop Drawings does not relieve the Contractor of responsibility for any errors that may exist. Contractor is responsible for the dimensions and design of adequate connections and details and for satisfactory construction of all the Work.

PART 2 – PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

END OF DOCUMENT

SITE STANDARDS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including without limitation, Site Access, Conditions, and Regulations;
- B. Special Conditions;
- C. Drug-Free Workplace Certification;
- D. Tobacco-Free Environment Certification;
- E. Criminal Background Investigation/Fingerprinting Certification;
- F. Temporary Facilities and Controls.

1.02 REQUIREMENTS OF THE DISTRICT:

- A. Drug-Free Schools and Safety Requirements:
 - (1) All school sites and other District Facilities have been declared “Drug-Free Zones.” No drugs, alcohol and/or smoking are allowed at any time in any buildings and/or grounds on District property. No students, staff, visitors, or contractors are to use drugs on these sites.
 - (2) Smoking and the use of tobacco products by all persons is prohibited on or in District property. District property includes school buildings, school grounds, school-owned vehicles and vehicles owned by others while on District property. Contractor shall post: "Non-Smoking Area" in a highly visible location in each work area, staging area, and parking area. Contractor may designate a smoking area outside of District property within the public right-of-way, provided that this area remains quiet and unobtrusive to adjacent neighbors. This smoking area is to be kept clean at all times.
 - (3) Contractor shall ensure that no alcohol, firearms, weapons, or controlled substances enter or are used at the Site. Contractor shall immediately remove from the Site and terminate the employment of any employee(s) found in violation of this provision.
- B. Language: Profanity or other unacceptable and/or loud language will not be tolerated, "Cat calls" or other derogatory language toward students, staff, volunteers, parents or public will not be allowed.
- C. Disturbing the Peace (Noise and Lighting):
 - (1) Contractor shall observe the noise ordinance of the Site at all times including, without limitation, all applicable local, city, and/or state laws, ordinances, and/or regulations regarding noise and allowable noise levels.

- (2) The use of radios, etc., shall be controlled to keep all sound at a level that cannot be heard beyond the immediate area of use. District reserves the right to prohibit the use of radios at the Site, except for mobile phones or other handheld communication radios.
- (3) If portable lights are used after dark, all light must be located so as not to direct light into neighboring property.

D. Traffic:

- (1) Driving on the Premises shall be limited to periods when students and public are not present. If driving or deliveries must be made during the school hours, two (2) or more ground guides shall lead the vehicle across the area of travel. In no case shall driving take place across playgrounds or other pedestrian paths during recess, lunch, and/or class period changes. The speed limit on the Premises shall be five (5) miles per hour (maximum) or less if conditions require.
- (2) All paths of travel for deliveries, including without limitation, material, equipment, and supply deliveries, shall be reviewed and approved by District in advance. Any damage will be repaired to the pre-damaged condition by the Contractor.
- (3) District shall designate a construction entry to the Site. If Contractor requests, District determines it is required, and to the extent possible, District shall designate a staging area so as not to interfere with the normal functioning of school facilities. Location of gates and fencing shall be approved in advance with District and at Contractor's expense.
- (4) Parking areas shall be reviewed and approved by District in advance. No parking is to occur under the drip line of trees or in softscape areas that could otherwise be damaged.

- E. All of the above shall be observed and complied with by the Contractor and all workers on the Site. Failure to follow these directives could result in individual(s) being suspended or removed from the work force at the discretion of the District. The same rules and regulations shall apply equally to delivery personnel, inspectors, consultants, and other visitors to the Site.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

END OF DOCUMENT

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Obtaining of Permits, Licenses and Registrations and Work to Comply with All Applicable Laws and Regulations;
- B. Special Conditions; and
- C. Quality Control.

1.02 DESCRIPTION:

This section covers the general requirements for regulatory requirements pertaining to the Work and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the Contract Documents.

1.03 REQUIREMENTS OF REGULATORY AGENCIES:

- A. All statutes, ordinances, laws, rules, codes, regulations, standards, and the lawful orders of all public authorities having jurisdiction over the Work, are hereby incorporated into these Contract Documents as if repeated in full herein and are intended to be included in any reference to Code or Building Code, unless otherwise specified, including, without limitation, the references in the list below. Contractor shall make available at the Site copies of all the listed documents applicable to the Work as the District and/or Architect may request, including, without limitation, applicable portions of the California Code of Regulations ("CCR").
 - (1) 2025 California Building Standards Administrative Code, Part 1, Title 24, CCR.
 - (2) 2022 California Building Code (CBC), Part 2, Title 24, CCR; (International Building Code volumes 1-2 and California Amendments).
 - (3) 2022 California Electrical Code (CEC), Part 3, Title 24, CCR; (National Electrical Code and California Amendments).
 - (4) 2022 California Mechanical Code (CMC), Part 4, Title 24, CCR; (Uniform Mechanical Code and California Amendments).
 - (5) 2022 California Plumbing Code (CPC), Part 5, Title 24, CCR; (Uniform Plumbing Code and California Amendments).
 - (6) 2022 California Fire Code (CFC), Part 9, Title 24, CCR; (International Fire Code and California Amendments).
 - (7) 2022 California Referenced Standards Code, Part 12, Title 24, CCR.
 - (8) State Fire Marshal Regulations, Public Safety, Title 19, CCR.

- (9) Partial List of Applicable National Fire Protection Association (NFPA) Standards:
 - (a) NFPA 13 - Automatic Sprinkler System.
 - (b) NFPA 14 - Standpipes Systems.
 - (c) NFPA 17A - Wet Chemical System
 - (d) NFPA 24 - Private Fire Mains.
 - (e) (California Amended) NFPA 72 - National Fire Alarm Codes.
 - (f) NFPA 253 - Critical Radiant Flux of Floor Covering System.
 - (g) NFPA 2001 - Clean Agent Fire Extinguishing Systems.
- (10) California Division of the State Architect interpretation of Regulations (“DSA IR”), including, without limitation:
 - (a) DSA IR A-6 — Construction Change Document Submittal and Approval Processes.
 - (b) DSA IR A-7 — Project Inspector Certification and Approval.
 - (c) DSA IR A-8 — Project Inspector and Assistant Inspector Duties and Performance.
- (11) DSA Procedures (“DSA PR”)
 - (a) DSA PR 13-01 – Construction Oversight Process
 - (b) DSA PR 13-02 – Project Certification Process

B. This Project shall be governed by applicable regulations, including, without limitation, the State of California’s Administrative Regulations for the Division of the State Architect-Structural Safety (DSA/SS), Chapter 4, Part 1, Title 24, CCR, and the most current version on the date the bids are opened and as it pertains to school construction including, without limitation:

- (1) Test and testing laboratory per Section 4-335. District shall pay for the testing laboratory.
- (2) Special inspections per Section 4-333(c).
- (3) Deferred Approvals per section 4-317(g).
- (4) Verified reports per Sections 4-336 & 4-343(c).
- (5) Duties of the Architect & Engineers shall be per Sections 4-333(a) and 4-341.
- (6) Duties of the Contractor shall be per Section 4-343.
- (7) Duties of Project Inspector shall be per Section 4-334.
- (8) Addenda and Construction Change Documents per Section 4-338.

Contractor shall keep and make available all applicable parts of the most current version of Title 24 referred to in the plans and specifications at the Site during construction.

C. Items of deferred approval shall be clearly marked on the first sheet of the Architect's and/or Engineer's approved Drawings. All items later submitted for approval shall be per Title 24 requirements to the DSA.

(1) Contractor shall submit the following to Architect for review and endorsement:

(a) Product information on proposed material/system supplier.

(b) Drawings, specifications, and calculations prepared, signed, and stamped by an architect or engineer licensed in the State of California for that portion of the Work.

(c) All other requirements as may be required by DSA.

(2) Cost of preparing and submitting documentation per DSA Deferred Approval requirements including required modifications to Drawings and Specifications, whether or not indicated in the Contract Documents, shall be borne by Contractor.

(3) Contractor shall not begin fabrication and installation of deferred approval items without first obtaining DSA approval of Drawings and Specifications.

PART 2 – PRODUCTS Not Used.

PART 3 – EXECUTION Not Used.

END OF DOCUMENT

CEQA MITIGATION MEASURES

PART 1 – GENERAL

1.01 SECTION INCLUDES:

- A. This Section specifies administrative and procedural requirements governing California Environmental Quality Act (CEQA) Mitigation Measures.

1.02 RELATED SECTIONS:

- A. General Conditions, including, without limitation, Obtaining of Permits, Licenses and Registrations and Work to Comply with All Applicable Laws and Regulations;
- B. Special Conditions; and
- C. Quality Control.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION

3.01 CEQA Mitigation Measure (MM) Requirements for Contractor:

Refer to the attached Mitigation Monitoring and Reporting Program. Contractor shall perform all items where the Contractor or Site Contractor is listed as the “Responsible/Monitoring Party”

END OF SECTION 01 41 11

MITIGATION, MONITORING, AND REPORTING PROGRAM

The Mitigation Monitoring and Reporting Program (MMRP) has been prepared in conformance with § 21081.6 of the Public Resources Code and § 15097 of the CEQA Guidelines, which require all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon a Mitigated Negative Declaration (MND) or an Environmental Impact Report (EIR). The MMRP ensures implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified through the use of monitoring and reporting. Monitoring is generally an ongoing or periodic process of project oversight; reporting generally consists of a written compliance review that is presented to the decision-making body or authorized staff person.

It is the intent of the MMRP to: (1) provide a framework for document implementation of the required mitigation; (2) identify monitoring/reporting responsibility; (3) provide a record of the monitoring/reporting; and (4) ensure compliance with those mitigation measures that are within the responsibility of the La Cañada Unified School District (District) to implement.

The following table lists impacts, mitigation measures adopted by the District in connection with approval of the proposed Project, responsible and monitoring parties, monitoring action, the project phase in which the measures are to be implemented, and enforcement agency.

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
BIOLOGICAL RESOURCES				
Threshold 4-a): Would the project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or US Fish and Wildlife Service?	MM BIO-1 Preconstruction Breeding Bird Survey In the event that Project construction or activities occur during February 15 through August 31, a qualified biologist shall complete a survey for nesting bird activity within the Project site and a 500-foot buffer (as access to adjacent areas allows), including areas with increased impacts resulting from noise disturbances, human activity, dust, vegetation clearing, ground-disturbing activities (e.g., staging, access, excavation, grading), and vibrations caused by heavy equipment. Nesting bird surveys shall be conducted at appropriate nesting times and concentrate on potential roosting or perch sites. A qualified biologist shall conduct bird surveys no more than 14 days prior to removing any trees or buildings to provide confirmation on the presence or absence of active nests in affected trees or buildings. Surveys shall be conducted should construction commence in areas not previously surveyed and in previously surveyed areas that have been undisturbed for at least 14 days prior to recommencing work for the duration during the bird nesting season. If an active nest is found, a qualified biologist shall determine the nesting status and set up a species-appropriate no-work buffer that should be no less than 300 feet initially (500 feet for raptor nests) or as determined by a qualified biologist depending on the species and location. Buffers shall be marked around the active nest site as directed by the qualified biologist and maintained during Project construction and activities. Buffers shall be increased if needed to protect the nesting birds. Removal of the affected trees or buildings shall be deferred, no additional Project activities shall be allowed inside buffers, and construction personnel shall be restricted from the area until a	District	Field verification	1. La Cañada Unified School District 2. During Project construction

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
	qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival. Construction personnel shall be instructed on the sensitivity of buffered areas. The buffer perimeter shall be fenced or adequately demarcated. A qualified biologist shall serve as a construction monitor during those periods when Project activities would occur near active nest areas to ensure that no inadvertent impacts on these nests would occur. Buffer fencing shall be constructed with materials that are not harmful to wildlife. Prohibited materials shall include, but are not limited to, spikes, glass, razor, or barbed wire. Vegetation clearing and grubbing activities when birds are likely to be nesting shall be monitored by a qualified biologist. Such activities shall only occur when a qualified biologist is present to ensure that these activities remain within the Project footprint (i.e., outside the demarcated buffer), that flagging/stakes/fencing are being maintained, and to minimize the likelihood that active nests are abandoned or fail due to Project activities.			
	MM BIO-2 Pre-Construction Clearance Survey A qualified biologist shall conduct a preconstruction clearance survey prior to vegetation removal to search for special-status wildlife resources that may be present within the construction area. The biologist shall be thoroughly familiar with the habitat requirements and life histories of special-status species that could occur. Should the special-status species, such as the legless lizard be detected, the biological shall either recommend an avoidance area or if avoidance is not possible then the biologist shall relocate the lizard out of harm's way in accordance with CDFW recommendations. The biologist shall submit survey results, including negative results, to CDFW following the survey and prior to the start of construction.	District	Field verification and survey results	1. La Cañada Unified School District/ California Department of Fish and Wildlife 2. During Project construction

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
	MM BIO-3 Bat Protection A qualified bat biologist shall conduct a bat survey within a 500-foot buffer (as access to adjacent areas allows) of the school, to identify trees and/or structures that could provide daytime and/or nighttime roost sites. Surveys shall include all areas that would experience increased impacts resulting from noise disturbances, human activity, dust, vegetation clearing, ground-disturbing activities (e.g., staging, access, excavation, grading), and vibrations caused by heavy equipment. If suitable roosting habitat is present, then acoustic recognition technology may be required to maximize detection of bats. Survey methodology and results, including negative findings, should be submitted to the California Department of Fish and Wildlife (CDFW) for review two weeks prior to initiation of Project activities. Should it be determined that roosting bats are present in the survey area and may be impacted during Project construction, the qualified bat biologist would coordinate with CDFW to identify avoidance and minimization measures and/or mitigation measures, such as seasonal exclusions, creation of new or replacement roofing/roosting habitat, installation of one-way doors that allow bats to exit but prevent bat reentry, to reduce impacts to bats to a level below significance.	District	Field verification and survey results	1. La Cañada Unified School District/ California Department of Fish and Wildlife 2. During Project construction

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
CULTURAL RESOURCES				
4.5-b Would the project cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?	MM CUL-1 Archaeological Resources Inadvertent Discovery In the event that any subsurface cultural resources are encountered during earth-moving activities, all work within 50 feet shall be halted until an archaeologist can evaluate the findings and make recommendations. Prehistoric materials can include flaked-stone tools (e.g., projectile points, knives, choppers) or obsidian, chert, or quartzite toolmaking debris; culturally darkened soil (i.e., midden soil often containing heat-affected rock, ash, and charcoal, shellfish remains, and cultural materials); and stone milling equipment (e.g., mortars, pestles, handstones). Historical materials might include wood, stone, or concrete footings, walls, and other structural remains; debris-filled wells or privies; and deposits of wood, metal, glass, ceramics, and other refuse. The archaeologist may evaluate the find in accordance with federal, state, and local guidelines, including those set forth in the California Public Resources Code Section 21083.2, to assess the significance of the find and identify avoidance or other measures as appropriate. If suspected prehistoric or historical archaeological deposits are discovered during construction, all work within the immediate area of the discovery shall be redirected and the find must be evaluated by a qualified archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards for archaeology.	District	Field verification	1. La Cañada Unified School District 2. During construction earth disturbance

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
GEOLOGY AND SOILS				
4.7-f Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	MM GEO-1 Paleontological Resources If paleontological resources are encountered during construction or the course of any ground-disturbance activities, all such activities within 50 feet of the find shall halt immediately. La Cañada Unified School District shall consult with a qualified paleontologist to determine the significance of the find. The assessment will follow SVP standards as delineated in the <i>Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources</i> (2010). If any find is determined to be significant, appropriate avoidance measures recommended by the consultant and approved by the La Cañada Unified School District must be followed unless avoidance is determined to be infeasible by the District. If avoidance is infeasible, other appropriate measures (e.g., data recovery, excavation) shall be instituted. If the fossils are determined to be significant, then the SVP-qualified paleontologist shall prepare and implement a data recovery plan. The plan shall include, but not be limited to, the following measures: - The paleontologist shall ensure that all significant fossils collected are cleaned, identified, catalogued, and permanently curated with an appropriate institution with a research interest in the materials (which may include the Natural History Museum of Los Angeles County); - The paleontologist shall ensure that specialty studies are completed, as appropriate, for any significant fossil collected; and	District	Field verification	- La Cañada Unified School District - During construction earth disturbance

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
	The paleontologist shall ensure that curation of fossils is completed in consultation with the City. A letter of acceptance from the curation institution shall be submitted to La Cañada Unified School District.			
HAZARDS AND HAZARDOUS MATERIALS				
4.9-b Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	MM HAZ-1 Hazardous Building Materials Abatement Due to the potential presence of polychlorinated biphenyl (PCB)-containing caulk, lead-containing paints and coatings, and asbestos-containing materials (ACMs) on the Project site, a Hazardous Material Abatement Plan shall be prepared which shall incorporate the Limited Asbestos and Lead Survey Report (December 21, 2022) results. Prior to the commencement of demolition, the general contractor shall prepare a detailed Hazardous Material Abatement Plan in accordance with regulatory requirements and the findings of the Limited Asbestos and Lead Survey Report (December 21, 2022). This plan shall be approved by the appropriate agencies prior to ground-disturbing activities. The Hazardous Material Abatement Plan shall be implemented prior to and during demolition activities to ensure that any hazardous materials on the Project site are properly identified, removed, and disposed of off-site at a landfill that can accept hazardous materials, and are removed from the site to prevent exposure to workers and the general public. The Hazardous Material Abatement Plan shall include a site-specific scope of work and specifications for the proper disposal of hazardous materials. The Hazardous Material Abatement Plan shall be prepared and implemented in accordance with the Asbestos National Emission Standards for Hazardous Air Pollutants and all other federal and state standards and	General Contractor	Field verification	- La Cañada Unified School District/ Department of Toxic Substances Control - Prior to demolition

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
	regulations, including those overseen by the California Department of Toxic Substances Control (DTSC), California Department of Education, and Office of Public School Construction.			
	MM HAZ-2 Soil Management Plan Due to the potential presence of arsenical pesticides and lead-based paint within soils at the Project site, a Soil Management Plan (SMP) shall be prepared in the event the DTSC has not provided a No Further Action letter. The SMP would be prepared that complies with all applicable regulatory requirements. The SMP shall be submitted to the La Cañada Unified School District for review and approval prior to the commencement of excavation and grading activities. The SMP shall be implemented during excavation and grading activities and require the following: - The general contractor shall remove and properly dispose of impacted materials in accordance with applicable requirements of the Department of Toxic Substances Control, and the Los Angeles County Fire Department. - Contaminated soils shall be transported from the Project site by a licensed transporter and disposed of at a licensed storage/treatment facility to prevent contaminated soils from becoming airborne or otherwise released into the environment.	District/General Contractor	Field verification	1. La Cañada Unified School District/ Department of Toxic Substances Control 2. Prior to demolition

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
NOISE				
4.13-b Would the project result in generation of excessive groundborne vibration or groundborne noise levels?	MM NOI-1 Vibratory Roller No vibratory roller shall be allowed to operate closer than 25 feet of any offsite residential structure. Any compaction that needs to occur within 25 feet of an offsite residential structure shall be performed with smaller equipment such as a plate compactor or by other methods such as multiple pass-bys with a skip loader.	General Contractor	Field verification	1. La Cañada Unified School District 2. During Project construction
TRANSPORTATION				
4.17-c Would the project substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	MM TRANS-1 Construction Traffic Management Plan A detailed Construction Traffic Management Plan shall be prepared in coordination with and approved by the La Cañada Unified School District. The Construction Traffic Management Plan shall require the General Contractor to schedule truck traffic and construction worker shifts to avoid creating trips during the peak traffic periods for the school, including during pick-up/drop-off time. All measures, including identified truck routes, shall be included in the Construction Management Plan. The plan shall include but is not limited to the following provisions: • Construction truck trips, including deliveries and the removal of heavy, oversized equipment and materials should be scheduled 30 minutes before and after the school's morning start and afternoon end bells outside of the school's pick-up/drop-off times, to reduce potential vehicle and pedestrian conflicts; • Designate construction work parking at the upper playground, and overflow parking would use available public parking locations along the street with a requirement	General Contractor	Traffic Management Plan	1. La Cañada Unified School District/ Department of Toxic Substances Control 2. During Project construction

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
	that at no time shall construction worker vehicles block any driveways. Contractors would be encouraged to carpool and would be required to observe parking regulations. If complaints are received by the School District or by the Principal of Paradise Canyon Elementary School regarding issues with construction worker vehicle parking, the Project construction contractor shall identify alternative parking options for construction workers so as not to interfere with parking availability; • Maintain emergency access on public roadways and within the school site during Project construction. Provide notice to and coordinate with emergency service providers, including the Los Angeles County Fire Department and Los Angeles County Sheriff's Department, regarding the construction schedule and worksite traffic control plans so as to coordinate emergency response routing and maintain emergency access; • Identification of haul routes for delivery or removal of heavy and/or oversized equipment or material loads; • Provide adequate signage and traffic flagger personnel, if needed, to control and direct traffic for deliveries, if they could preclude free flow of traffic in both directions or cause a temporary traffic hazard; • Educate staff, students, and parents on pick-up/drop-off routes and procedures for each construction phase, if different from the previous. This may be achieved with a combination of information bulletins shared with students and parents.			

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
	• Maintain pedestrian connections around the Project site. Safe crossing locations shall be designated, as needed; and • Maintain the security of the Project site by erecting temporary fencing during the construction phase of the Project. Any on-site night lighting used during the construction phase of the Project shall be directed towards construction areas, and shielded from residential uses.			
PROJECT DESIGN FEATURES				
Project Design Feature	PDF-BIO-1 Coast Live Oak Tree Protection During Project construction, the measures described below shall be taken to protect any coast live oak trees designated to be preserved and for which the root systems are located near and vulnerable to damage by construction activities. These measures shall be performed by a certified arborist or under the supervision of a certified arborist and/or qualified restoration professional. The exposed tap root, main roots, and any surface-feeding roots exceeding 1 inch in diameter shall be wrapped in protective moistened burlap during the excavation of existing pavement and buildings and during the regrading phase and installation of the new parking lot. The roots zone (under dripline) and 5 feet from the drip line shall be excavated with hand tools, using a probe (metal rod or stick) to locate and unearth roots, leaving them in their natural orientation. A mini excavator shall be used only if absolutely necessary. Work will be done as quickly as possible to expose the roots for as little time as possible and the roots will be reburied with clean fill as soon as is feasible (no longer than a day or so, if possible). The burlap will be kept moist. Efforts will be made to avoid cutting roots. If roots need to be cut, they will be cut with sharpened,	District	Field verification	1. La Cañada Unified School District 2. During Project construction

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
	clean, disinfected tools (10 percent bleach solution) with every effort to avoid tearing the root and root surface. A minimum distance of 8 feet should be maintained of the root (distance from the root crown to terminal end of root), where possible. If the current elevation of the trees' existing root collars differs by more than 1 foot from the new grade, then a 10-foot radius of soil at the root collar grade shall be placed around each tree. If a certified arborist or and/or qualified restoration professional determines work is being performed improperly, that individual(s) shall stop work and determine the best course of action to avoid any tree damage or mortality before restarting work. These procedures have a potential to cause decreased health (greater than 25 percent signs of visible stress) or mortality of any oak trees designated to be preserved. If any root-disturbing activities are determined to have caused irreversible impacts that may eventually lead to decreased health or mortality of any oak tree, those activities and potential impacts shall be documented immediately. All documentation shall be summarized in a report provided to the La Cañada Unified School District. Preserved oak trees that may succumb to impacts shall be replaced with oak trees that are of the same species and variety. Placement of fill dirt, staging areas, chemicals, or debris should be away from any oak trees designated to be preserved.			
Project Design Feature	PDF BIO-2 Coast Live Oak Planting Measure If coast live oak trees are proposed to be removed during construction, to offset the loss of native trees, the District and landscape architect shall work with a certified arborist and/or qualified restoration professional to select the most appropriate location for replacement coast live oak trees. Coast live oak	District	Field verification	- La Cañada Unified School District - During Project construction

IMPACT	MITIGATION MEASURE	RESPONSIBLE/ MONITORING PARTY	MONITORING ACTION	1. ENFORCEMENT AGENCY 2. IMPLEMENTATION
	trees shall not be planted in any area that will be subject to future modernization projects or ground disturbance work that may impact replacement trees. Locations shall have appropriate biological or physical factors required by coast live oak trees to grow and persist where possible. The District and landscape architect shall work with a certified arborist and/or qualified restoration professional to acquire appropriately sized, locally sourced coast live oak trees from a local native plant nursery that implements <i>Phytophthora</i>/Clean Nursery Stock protocols. This may reduce the probability of introducing coast live oak trees contaminated with pests, diseases, and pathogens that could spread and infect native oak trees or habitats. A certified arborist and/or qualified restoration professional shall inspect and potentially quarantine nursery stock before bringing them into the Project site and supervise the installation/transplanting of the coast live oak trees. The District shall protect and monitor the survivorship of planted coast live oak trees until the trees begin to produce seeds. The District shall consult with the certified arborist and/or qualified restoration professional on a long-term maintenance plan to provide protective caging, shading, and irrigation. Oak trees shall be protected from trampling, damage, or climbing. The District shall also consult with the certified arborist and/or qualified restoration professional if coast live oak trees show symptoms of stress and determine the appropriate response to prevent mortality.			

ABBREVIATIONS AND ACRONYMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions including without limitation, Definitions;
- B. Special Conditions.

1.02 DOCUMENT INCLUDES:

- A. Abbreviations used throughout the Contract Documents.
- B. Reference to a technical society, organization, or body is by abbreviation, as follows:

1.	AA	The Aluminum Association
2.	AAMA	American Architectural Manufacturers Association
3.	AASHTO	American Association of State Highway and Transportation Officials
4.	ABPA	Acoustical and Board Products Association
5.	ACI	American Concrete Institute
6.	AGA	American Gas Association
7.	AGC	Associated General Contractors of America
8.	AHC	Architectural Hardware Consultant
9.	AI	Asphalt Institute
10.	AIA	American Institute of Architects
11.	AIEE	American Institute of Electrical Engineers
12.	AISC	American Institute of Steel Construction
13.	AISI	American Iron and Steel Institute
14.	AMCA	Air Moving and Conditioning Association
15.	ANSI	American National Standards Institute
16.	APA	American Plywood Association
17.	ARI	Air Conditioning and Refrigeration Institute
18.	ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
19.	ASME	American Society of Mechanical Engineers
20.	ASSE	American Society of Structural Engineers
21.	ASTM	American Society of Testing and Materials
22.	AWPB	American Wood Preservers Bureau
23.	AWPI	American Wood preservers Institute
24.	AWS	American Welding Society
25.	AWSC	American Welding Society Code
26.	AWI	Architectural Woodwork Institute
27.	AWWA	American Water Works Association
28.	BIA	Brick Institute of America
29.	CCR	California Code of Regulations
30.	CLFMI	Chain Link Fence Manufacturers Institute
31.	CMG	California Masonry Guild

32.	CRA	California Redwood Association
33.	CRSI	Concrete Reinforcing Steel Institute
34.	CS	Commercial Standards
35.	CSI	Construction Specifications Institute
36.	CTI	Cooling Tower Institute
37.	FGMA	Flat Glass Manufacturer's Association
38.	FIA	Factory Insurance Association
39.	FM	Factory Mutual
40.	FS	Federal Specification
41.	FTI	Facing Title Institute
42.	GA	Gypsum Association
43.	ICC	International Code Council
44.	IEEE	Institute of Electrical and Electronic Engineers
45.	IES	Illumination Engineering Society
46.	LIA	Lead Industries Association
47.	MIA	Marble Institute of America
48.	MLMA	Metal Lath Manufacturers Association
49.	MS	Military Specifications
50.	NAAMM	National Association of Architectural Metal Manufacturers
51.	NBHA	National Builders Hardware Association
52.	NBFU	National Board of Fire Underwriters
53.	NBS	National Bureau of Standards
54.	NCMA	National Concrete Masonry Association
55.	NEC	National Electrical Code
56.	NEMA	National Electrical Manufacturers Association
57.	NFPA	National Fire Protection Association/National Forest Products Association
58.	NMWIA	National Mineral Wool Insulation Association
59.	NTMA	National Terrazzo and Mosaic Association
60.	NWMA	National Woodwork Manufacturer's Association
61.	ORS	Office of Regulatory Services (California)
62.	OSHA	Occupational Safety and Health Act
63.	PCI	Precast Concrete Institute
64.	PCA	Portland Cement Association
65.	PDCA	Painting and Decorating Contractors of America
66.	PDI	Plumbing Drainage Institute
67.	PEI	Porcelain Enamel Institute
68.	PG&E	Pacific Gas & Electric Company
69.	PS	Product Standards
70.	SDI	Steel Door Institute; Steel Deck Institute
71.	SJI	Steel Joist Institute
72.	SSPC	Steel Structures Painting Council
73.	TCA	Tile Council of America
74.	TPI	Truss Plate Institute
75.	UL	Underwriters Laboratories Code
76.	UMC	Uniform Mechanical Code
77.	USDA	United States Department of Agriculture
78.	VI	Vermiculite Institute
79.	WCLA	West Coast Lumberman's Association
80.	WCLB	West Coast Lumber Bureau
81.	WEUSER	Western Electric Utilities Service Engineering Requirements
82.	WIC	Woodwork Institute of California
83.	WPOA	Western Plumbing Officials Association

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

END OF DOCUMENT

DEFINITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions including without limitation, Definitions;
- B. Special Conditions.

1.02 QUALITY ASSURANCE

- A. For products or workmanship specified by association, trade, or Federal Standards, Contractor shall comply with requirements of the standard, except when more rigid requirements are specified in the Contract Documents, or are required by applicable codes.
- B. Contractor shall conform to current reference standard publication date in effect on the date of bid opening.
- C. Contractor shall obtain copies of standards unless specifically required not to by the Contract Documents.
- D. Contractor shall maintain a copy of all standards at jobsite during submittals, planning, and progress of the specific Work, until final completion, unless specifically required not to by the Contract Documents.
- E. Should specified reference standards conflict with Contract Documents, Contractor shall request clarification from the District and/or the Architect before proceeding.
- F. The contractual relationship of the parties to the Contract shall not be altered from the contractual relationship as indicated in the Contract Documents by mention or inference otherwise in any referenced document.
- G. Governing Codes shall be as shown in the Contract Documents including, without limitation, the Specifications.

END OF DOCUMENT

REFERENCES**PART 1 - GENERAL****1.01 SCHEDULE OF REFERENCES:**

The following information is intended only for the general assistance of the Contractor, and the District does not represent that all of the information is current. It is the Contractor's responsibility to verify the correct information for each of the entities listed.

AA	The Aluminum Association 1400 Crystal Drive, Suite 430 Arlington, VA 22202 www.aluminum.org	703/358-2960
AABC	Associated Air Balance Council 1518 K Street, NW, Suite 503 Washington, DC 20005 www.aabc.com	202/737-0202
AAMA	American Architectural Manufacturers Association 1827 Walden Office Sq., Suite 550 Schaumburg, IL 60173-4268 www.aamanet.org	847/303-5664
AASHTO	American Association of State Highway and Transportation Officials 444 N Capitol St. NW - Suite 249 Washington, DC 20001 www.transportation.org	202/624-5800
AATCC	American Association of Textile Chemists and Colorists P.O. Box 12215 One Davis Drive Research Triangle Park, NC 27709 2215 www.aatcc.org	919/549-8141
ACA	American Coatings Association 1500 Rhode Island Ave., NW Washington DC, 20005 www.paint.org	202/462-6272

ACI	American Concrete Institute 38800 Country Club Dr. Farmington Hills, MI 48331-3439 www.concrete.org	248/848-3700
ACPA	American Concrete Pipe Association 8445 Freeport Parkway, Suite 350 Irving, TX 75063-2595 www.concrete-pipe.org	972/506-7216
ADC	Air Duct Council 1901 N. Roselle Road, Suite 800 Schaumburg, Illinois 60195 www.flexibleduct.org	847/706-6750
AF&PA	American Forest and Paper Association 1101 K Street, NW, Suite 700 Washington, DC 20005 www.afandpa.org	202/463-2700
AGA	American Gas Association 400 North Capitol Street, NW Washington, DC 20001 www.aga.org	202/824-7000
AGC	Associate General Contractors of America 2300 Wilson Blvd., Suite 300 Arlington, VA 22201 www.agc.org	703/548-3118
AHA	American Hardboard Association 1210 West Northwest Highway Palatine, IL 60067 domensino.com/AHA/default.htm	847/934-8800
AI	Asphalt Institute 2696 Research Park Drive Lexington, KY 40511-8480 www.asphaltinstitute.org	859/288-4960
AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006-5292 www.aia.org	202/626-7300
AISC	American Institute of Steel Construction 130 East Randolph Street Suite 2000 Chicago, IL 60601 www.aisc.org	312.670.2400

AIA	American Insurance Association (formerly the National Board of Fire Underwriters) 555 12th St, NW, Suite 550 Washington DC 20004 www.aiadc.org	202/828-7100
AISI	American Iron and Steel Institute 25 Massachusetts Ave., NW, Suite 800 Washington, DC 20001 www.steel.org	202/452.7100
AITC	American Institute of Timber Construction 7012 S. Revere Parkway Suite 140 Centennial, CO 80112 www.aitc-glulam.org	503/639.0651
ALI	Associated Laboratories, Inc. P.O. Box 152837 Dallas, TX 75315 www.assoc-labs.com	214/565-0593
ALSC	American Lumber Standards Committee, Inc. 7470 New Technology Way, Suite F Frederick, MD 21703 www.alsc.org	301/972-1700
AMCA	Air Movement and Control Association International, Inc. 30 W. University Drive Arlington Heights, IL 60004 www.amca.org	847/394-0150
ANLA	American Nursery & Landscape Association (now AmericanHort) 525 9 th St NW, Suite 80 Washington, DC 20004 www.americanhort.org	202/789-2900
ANSI	American National Standards Institute 1899 L Street, NW, 11th Floor Washington, DC, 20036 www.ansi.org	202/293.8020
APA	APA-The Engineered Wood Association 7011 S. 19th Street Tacoma, WA 98466-5333 www.apawood.org	253/565-6600

APA	Architectural Precast Association 325 John Know Rd, Ste L103 Tallahassee, FL 32303 www.archprecast.org	850/205.5637
ARI	Air Conditioning and Refrigeration Institute (now Air-Conditioning, Heating, & Refrigeration Institute) 2111 Wilson Blvd, Suite 500 Arlington, VA 22201 www.ahrinet.org	703/524-8800
ARMA	Asphalt Roofing Manufacturers Association Public Information Department 750 National Press Building 529 14th Street, NW Washington, DC 20045 www.asphaltroofing.org	202/591-2450
ASA	The Acoustical Society of America ASA Office Manager Suite 1N01 2 Huntington Quadrangle Melville, NY 11747-4502 http://asa.aip.org	516/576-2360
ASCE	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191 www.asce.org	800/548-2723 703/295-6300
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329-2305 www.ashrae.org	800/527-4723 404/636-8400
ASLA	American Society of Landscape Architects 636 Eye Street, NW Washington, DC 20001-3736 www.asla.org	202/898-2444
ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016-5990 www.asme.org	800/434-2763
ASPE	American Society of Plumbing Engineers 2980 S River Rd. Des Plaines, IL 60018 http://aspe.org	847/296-0002

ASQ	American Society for Quality P.O. Box 3005 Milwaukee, WI 53201-3005 or 600 North Plankinton Avenue Milwaukee, WI 53203 http://asq.org	800/248-1946 414/272-8575
ASSE	American Society of Sanitary Engineering 901 Canterbury, Suite A Westlake, Ohio 44145 www.asse-plumbing.org	440/835-3040
ASTM	ASTM International 100 Barr Harbor Drive PO Box C700 West Conshohocken, PA, 19428-2959 www.astm.org	610/832-9500
AWCI	Association of the Wall and Ceiling Industry 513 West Broad Street, Suite 210 Falls Church, VA 22046 www.awci.org	703/538-1600
AWPA	American Wood Protection Association P.O. Box 361784 Birmingham, AL 35236-1784 www.awpa.com	205/733-4077
AWPI	American Wood Preservers Institute 2750 Prosperity Ave. Suite 550 Fairfax, VA 22031-4312 www.arcat.com	800/356-AWPI 703/204-0500
AWS	American Welding Society 8669 Doral Boulevard, Suite 130 Doral, Florida 33166 www.aws.org	800/443-9353 305/443-9353
AWI	Architectural Woodwork Institute 46179 Westlake Drive, Suite 120 Potomac Falls, VA 20165-5874 www.awinet.org	571/323-3636
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235 www.awwa.org	800/926-7337 303/794 7711
BHMA	Builders Hardware Manufacturers Association 355 Lexington Avenue, 15th floor New York, NY 10017 www.buildershardware.com	212/297-2122

BIA	The Brick Industry Association 1850 Centennial Park Drive, Suite 301 Reston, VA 20191 www.gobrick.com	703/620-0010
CGA	Compressed Gas Association 14501 George Carter Way, Suite 103 Chantilly VA 20151-2923 www.cganet.com	703/788-2700
CISCA	Ceilings & Interior Systems Construction Association 1010 Jorie Blvd, Suite 30 Oak Brook, IL 60523 www.cisca.org	630/584-1919
CISPI	Cast Iron Soil Pipe Institute 1064 Delaware Avenue SE Atlanta, GA 30316 www.cispi.org	404/622-0073
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Columbia Road, Suite B-215 Columbia, MD 21046 www.associationsites.com/main-pub.cfm?usr=clfma	410/290-6267
CPA	Composite Panel Association 19465 Deerfield Avenue, Suite 306 Leesburg, VA 20176 www.compositepanel.org	703/724-1128
CPSC	Consumer Product Safety Commission 4330 East West Highway Bethesda, MD 20814 www.cpsc.gov	301/504-7923 800/638-2772
CRA	California Redwood Association 405 Enfrente Drive, Suite 200 Novato, CA 94949 www.calredwood.org	415/382-0662
CRI	Carpet and Rug Institute P.O. Box 2048 Dalton, Georgia 30722-2048 www.carpet-rug.org	706/278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Road Schaumburg, IL 60173 4758 www.crsi.org	847/517-1200
CSI	The Construction Specifications Institute 110 South Union Street, Suite 100 Alexandria VA 22314 www.csinet.org	800/689-2900

CTIOA	Ceramic Tile Institute of America 12061 Jefferson Blvd. Culver City, CA 90230-6219 www.ctioa.org	310/574-7800
DHI	Door and Hardware Institute (formerly National Builders Hardware Association) 14150 Newbrook Dr. Chantilly, VA 20151 www.dhi.org	703/222-2010
DIPRA	Ductile Iron Pipe Research Association 2000 2nd Avenue, South Suite 429 Birmingham, AL 35233 www.dipra.org	205/402-8700
DOC	U.S. Department of Commerce 1401 Constitution Ave., NW Washington, D.C. 20230 www.commerce.gov	202/482-2000
DOT	U.S. Department of Transportation 1200 New Jersey Avenue, SE Washington, DC 20590 www.dot.gov	855/368-4200
EJMA	Expansion Joint Manufacturers Association, Inc. 25 North Broadway Tarrytown, NY 10591 www.ejma.org	914/332-0040
EPA	Environmental Protection Agency Ariel Rios Building 1200 Pennsylvania Avenue, N.W. Washington, DC 20460 www.epa.gov	202/272-0167
FCICA	Floor Covering Installation Contractors Association 7439 Millwood Drive West Bloomfield, MI 48322 www.fcica.com	248/661-5015 877/TO-FCICA
FM Global	Factory Mutual Insurance Company Amy Daley Global Practice Leader – Education, Public Entities, Health Care FM Global 270 Central Avenue Johnston, RI 02919-4949 www.fmglobal.com	401/275-3000 401/275-3029

FS	General Services Administration (GSA) Index of Federal Specifications, Standards and Commercial Item Descriptions 470 East L'Enfant Plaza, SW, Suite 8100 Washington, DC 20407 www.gsa.gov	202/619-8925
GA	The Gypsum Association 6525 Belcrest Road, Suite 480 Hyattsville, MD 20782 www.gypsum.org	301/277-8686
GANA	Glass Association of North America 800 SW Jackson St., Suite 1500 Topeka, KS 66612-1200 www.glasswebsite.com	785/271-0208
HMA	Hardwood Manufacturers Association 665 Rodi Road, Suite 305 Pittsburgh, PA 15235 http://hmamembers.org	412/244-0440
HPVA	Hardwood Plywood & Veneer Association 1825 Michael Faraday Drive Reston, Virginia 20190 www.hpva.org	703/435-2900
IAPMO	International Association of Plumbing and Mechanical Officials (formerly the Western Plumbing Officials Association) 4755 E. Philadelphia St. Ontario, CA 91761 www.iapmo.org	909/472-4100
ICC	International Code Council 500 New Jersey Avenue, NW, 6th Floor Washington, DC 20001 www.iccsafe.org	888/422-7233
IEEE	Institute of Electrical and Electronics Engineers 3 Park Avenue, 17th Floor New York, NY 10016-5997 www.ieee.org	212/419-7900
IES	Illuminating Engineering Society 120 Wall Street, Floor 17 New York, NY 10005-4001 www.ies.org	212/248-5000
ITRK	Intertek Testing Services 3933 US Route 11 Cortland, NY 13045 www.intertek.com	607/753-6711

MCAA	Mechanical Contractors Association of America 1385 Piccard Drive Rockville, MD 20850 www.mcaa.org	301/869-5800
MIA	Marble Institute of America 28901 Clemens Rd, Ste 100 Cleveland, OH 44145 www.marble-institute.com	440/250-9222
MMPA (formerly WMMPA)	Moulding & Millwork Producers Association (formerly Wood Moulding & Millwork Producers Association) 507 First Street Woodland, CA 95695 www.wmmpa.com	530/661-9591 800/550-7889
MSS	Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry 127 Park Street, NE Vienna, VA 22180-4602 http://mss-hq.org	703/281-6613
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt Rd. Bldg. C, Suite 312 Glen Ellyn, IL 60137 www.naamm.org	630/942-6591
NAIMA	North American Insulation Manufacturers Association 44 Canal Center Plaza, Suite 310 Alexandria, VA 22314 www.naima.org	703/684-0084
NAPA	National Asphalt Pavement Association 5100 Forbes Blvd. Lanham, MD USA 20706-4407 www.asphaltpavement.org	888/468-6499 301/731-4748
NCSPA	National Corrugated Steel Pipe Association 14070 Proton Road, Suite 100 LB9 Dallas, TX 75244 www.ncspa.org	972/850-1907
NCMA	National Concrete Masonry Association 13750 Sunrise Valley Drive Herndon, VA 20171-4662 www.ncma.org	703/713-1900
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877 www.nebb.org	301/977-3698

NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814 www.necanet.org	301/657-3110
NEMA	National Electrical Manufacturers Association 1300 North 17th Street, Suite 1752 Rosslyn, Virginia 22209 www.nema.org	703/841-3200
NEII	National Elevator Industry, Inc. 1677 County Route 64 P.O. Box 838 Salem, New York 12865-0838 www.neii.org	518/854-3100
NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, Massachusetts USA 02169-7471 www.nfpa.org	617/770-3000
NHLA	National Hardwood Lumber Association PO Box 34518 Memphis, TN 38184 www.nhla.com	901/377-1818
NIA	National Insulation Association 12100 Sunset Hills Road, Suite 330 Reston, VA 20190 www.insulation.org	703/464-6422
NRCA	National Roofing Contractors Association 10255 W. Higgins Road, Suite 600 Rosemont, IL 60018-5607 www.nrca.net	847/299-9070
NSF	NSF International P.O. Box 130140 789 N. Dixboro Road Ann Arbor, MI 48113-0140, USA www.nsf.org	800/673-6275 734/769-8010
NTMA	National Terrazzo and Mosaic Association PO Box 2605 Fredericksburg, TX 78624 www.ntma.com	800/323-9736
OSHA	Occupational Safety and Health Act U.S. Department of Labor Occupational Safety & Health Administration 200 Constitution Ave., NW Washington, D.C. 20210 www.osha.gov	800/321-OSHA (6742)

PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077 or 500 New Jersey Ave., N.W. 7 th Floor Washington, D.C. 20001 www.cement.org	847/966-6200 202/408-9494
PCI	Precast/Prestressed Concrete Institute 200 W. Adams St. #2100 Chicago, IL 60606 www.pci.org	312/786-0300
PDCA	Painting and Decorating Contractors of America 2316 Millpark Drive, Ste 220 Maryland Heights, MO 63043 www.pdca.com	800/332-PDCA (7322) 314/514-7322
PDI	Plumbing & Drainage Institute 800 Turnpike Street, Suite 300 North Andover, MA 01845 http://pdionline.org	978/557-0720 800/589-8956
PEI	Porcelain Enamel Institute, Inc. P.O. Box 920220 Norcross, GA 30010 www.porcelainenamel.com	770/676-9366
PG&E	Pacific Gas & Electric Company www.pge.com	800/743-5000
PLANET	Professional Landcare Network 950 Herndon Parkway, Suite 450 Herndon, Virginia 20170 www.landcarenetwork.org	703/736-9666 800/395-2522 703/736-9668
RFCI	Resilient Floor Covering Institute 115 Broad Street, Suite 201 La Grange GA 30240 www.rfci.com	706/882-3833
RIS	Redwood Inspection Service 818 Grayson Road, Suite 201 Pleasant Hill, CA 94523 www.redwoodinspection.com	925/935-1499
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021 www.sdi.org	847/458-4647

SDI	Steel Door Institute 30200 Detroit Road Westlake, Ohio 44145 www.steeldoor.org	440/899-0010
SJI	Steel Joist Institute 234 W. Cheves Street Florence, SC 29501 http://steeljoist.org	843/407-4091
SMA	Stucco Manufacturers Association 500 East Yale Loop Irvine, CA 92614 www.stuccomfgassoc.com	949/387.7611
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Drive Chantilly, Virginia 20151-1219 www.smacna.org	703/803-2980
SPI	SPI: The Plastics Industry Trade Association, Inc. 1667 K St., NW, Suite 1000 Washington, DC 20006 www.plasticsindustry.org	202/974-5200
SSPC	Society for Protective Coatings (formerly the Steel Structures Painting Council) 40 24th St 6th Fl Pittsburgh, PA 15222 www.sspc.org	412/281-2331 877/281-7772
TCA	The Tile Council of North America 100 Clemson Research Blvd. Anderson, SC 29625 www.tcnatile.com	864/646-8453
TPI	Truss Plate Institute 218 North Lee Street, Suite 312 Alexandria, VA 22314 www.tpinst.org	703/683-1010
TPI	Turfgrass Producers International 2 East Main Street East Dundee, IL 60118 www.turfgrasssod.org	800/405-8873 847/649-5555
TCIA	Tree Care Industry Association (formerly the National Arborist Association) 136 Harvey Road, Suite 101 Londonderry, NH 03053 www.tcia.org	800/733-2622

TVI	The Vermiculite Institute c/o The Schundler Company 150 Whitman Avenue Edison, NJ. 08817 www.vermiculiteinstitute.org	732/287-2244
UL	Underwriters Laboratories Inc. 333 Pfingsten Road Northbrook, IL 60062-2096 www.ul.com	847/272-8800 877/854-3577
UNI	Uni-Bell PVC Pipe Association 2711 LBJ Freeway, Suite 1000 Dallas, TX 75234 www.uni-bell.org	972/243-3902
USDA	U.S. Department of Agriculture 1400 Independence Ave., S.W. Washington, DC 20250 www.usda.gov	202/720-2791
WA	Wallcoverings Association 401 North Michigan Avenue Suite 2200 Chicago, IL 60611 www.wallcoverings.org	312/321-5166
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281 or 6980 S.W. Varns Tigard, OR 97223 www.wclib.org	503/639-0651
WCMA	Window Covering Manufacturers Association 355 Lexington Avenue 15th Floor New York, New York 10017 www.wcmanet.org	212/297-2122
WDMA	Window & Door Manufacturers Association 401 N. Michigan Avenue, Suite 2200 Chicago, IL 60611 or 2025 M Street, NW, Ste. 800 Washington, D.C. 20036-3309 www.wdma.com	312/321-6802 202/367-1157
WI	Woodwork Institute P.O. Box 980247 West Sacramento, CA 95798 www.wicnet.org	916/372-9943

WRI	Wire Reinforcement Institute 942 Main Street Hartford, CT 06103 www.wirereinforcementinstitute.org	860/240-9545
WWCA	Western Wall & Ceiling Contractors Association 1910 N. Lime St. Orange, California 92865 www.wwcca.org	714/221-5520
WWPA	Western Wood Products Association 522 SW Fifth Ave., Suite 500 Portland, OR 97204-2122 www2.wwpa.org	503/224-3930

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

END OF DOCUMENT

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Purchase of Materials and Equipment;
- B. Special Conditions;
- C. Imported Materials Certification.

1.02 MATERIAL AND EQUIPMENT

- A. Only items approved by the District and/or Design Professional shall be used.
- B. Contractor shall submit lists of products and other product information in accordance with the Contract Documents, including, without limitation, the provisions regarding the submittals.

1.03 MATERIAL AND EQUIPMENT COLORS

- A. The District and/or Architect will provide a schedule of colors.
- B. No individual color selections will be made until after approval of all pertinent materials and equipment and after receipt of appropriate samples in accordance with the Contract Documents, including, without limitation, the provisions regarding the submittals.
- C. Contractor shall request priority in writing for any item requiring advance ordering to maintain the approved Construction Schedule.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall deliver manufactured materials in original packages, containers, or bundles (with seals unbroken), bearing name or identification mark of manufacturer.
- B. Contractor shall deliver fabrications in as large assemblies as practicable; where specified as shop-primed or shop-finished, package or crate as required to preserve such priming or finish intact and free from abrasion.
- C. Contractor shall store materials in such a manner as necessary to properly protect them from damage. Materials or equipment damaged by handling, weather, dirt, or from any other cause will not be accepted.
- D. Materials are not acceptable that have been warehoused for long periods of time, stored or transported in improper environment, improperly packaged, inadequately labeled, poorly protected, excessively shipped, deviated from normal distribution pattern, or reassembled.

- E. Contractor shall store material so as to cause no obstructions of sidewalks, roadways, access to the Site or buildings, and underground services. Contractor shall protect material and equipment furnished under Contract.
- F. Contractor may store materials on Site with prior written approval by the District, all material shall remain under Contractor's control and Contractor shall remain liable for any damage to the materials. Should the Project Site not have storage area available, the Contractor shall provide for off-site storage at a bonded warehouse and with appropriate insurance coverage at no cost to District.
- G. When any room in Project is used as a shop or storeroom, the Contractor shall be responsible for any repairs, patching, or cleaning necessary due to that use. Location of storage space shall be subject to prior written approval by District.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers listed in various sections of Contract Documents are names of those manufacturers that are believed to be capable of supplying one or more of items specified therein.
- B. The listing of a manufacturer does not imply that every product of that manufacturer is acceptable as meeting the requirements of the Contract Documents.

2.02 FACILITIES AND EQUIPMENT

Contractor shall provide, install, maintain, and operate a complete and adequate facility for handling, the execution, disposal, and distribution of material and equipment as required for proper and timely performance of Work connected with Contract.

2.03 MATERIAL REFERENCE STANDARDS

Where material is specified solely by reference to "standard specifications" and if requested by District, Contractor shall submit for review data on actual material proposed to be incorporated into Work of Contract listing name and address of vendor, manufacturer, or producer, and trade or brand names of those materials, and data substantiating compliance with standard specifications.

PART 3 - EXECUTION

3.01 WORKMANSHIP

- A. Where not more specifically described in any other Contract Documents, workmanship shall conform to methods and operations of best standards and accepted practices of trade or trades involved and shall include items of fabrication, construction, or installation regularly furnished or required for completion (including finish and for successful operation, as intended).
- B. Work shall be executed by tradespersons skilled in their respective lines of Work. When completed, parts shall have been durably and substantially built and present a neat appearance.

3.02 COORDINATION

- A. Contractor shall coordinate installation of Work so as to not interfere with installation of others. Adjustment or rework because of Contractor's failure to coordinate will be at no additional cost to District.

- B. Contractor shall examine in-place work for readiness, completeness, fitness to be concealed or to receive other work, and in compliance with Contract Documents. Concealing or covering Work constitutes acceptance of additional cost which will result should in-place Work be found unsuitable for receiving other Work or otherwise deviating from the requirements of the Contract Documents.

3.03 COMPLETENESS

Contractor shall provide all portions of the Work, unless clearly stated otherwise, installed complete and operational with all elements, accessories, anchorages, utility connections, etc., in manner to assure well-balanced performance, in accordance with manufacturer's recommendations and by Contract Documents. For example, electric water coolers require water, electricity, and drain services; roof drains require drain system; sinks fit within countertop, etc. Terms such as "installed complete," "operable condition," "for use intended," "connected to all utilities," "terminate with proper cap," "adequately anchored," "patch and refinish," "to match similar," should be assumed to apply in all cases, except where completeness of functional or operable condition is specifically stated as not required.

3.04 APPROVED INSTALLER OR APPLICATOR

Installation by a manufacturer's approved installer or applicator is an understood part of Specifications and only approved installer or applicator is to provide on-site Work where specified manufacturer has on-going program of approving (i.e. certifying, bonding, re-warranting) installers or applicators. Newly established relationships between a manufacturer and an installer or applicator who does not have other approved applicator work in progress or completed is not approved for this Project.

3.05 MANUFACTURER'S RECOMMENDATIONS

All installations shall be in accordance with manufacturer's published recommendations and specific written directions of manufacturer's representative. Should Contract Documents differ from recommendations of manufacturer or directions of his representative, Contractor shall analyze differences, make recommendations to the District and the Architect in writing, and shall not proceed until interpretation or clarification has been issued by the District and/or the Architect.

END OF DOCUMENT

QUALITY CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Inspector, Inspections and Tests, Uncovering of Work and Non-conforming of Work and Correction of Work;
- B. Special Conditions.

1.02 RELATED CODES:

- A. The Work is governed by requirements of Title 24, California Code of Regulations (“CCR”), and the Contractor shall keep a copy of these available at the job Site for ready reference during construction.
- B. The Division of the State Architect (“DSA”) shall be notified at or before the start of construction.

1.03 OBSERVATION AND SUPERVISION:

- A. The District and Architect or their appointed representatives will review the Work and the Contractor shall provide facilities and access to the Work at all times as required to facilitate this review. Administration by the Architect and any consulting Structural Engineer will be in accordance with applicable regulations, including, without limitation, CCR, Part 1, Title 24, Section 4-341.
- B. One or more Project Inspector(s) approved by DSA and employed by or in contract with the District, referred to hereinafter as the “Project Inspector”, will observe the work in accordance with CCR, Part 1, Title 24, Sections 4-333(b) and 4-342:
 - (1) The Project Inspector and Special Inspector(s) shall have access to the Work wherever it is in preparation or progress for ascertaining that the Work is in accordance with the Contract Documents and all applicable code sections. The Contractor shall provide facilities and operation of equipment as needed, and access as required and shall provide assistance for sampling or measuring materials.
 - (2) The Project Inspector will notify the District and Architect and call the attention of the Contractor to any observed failure of Work or material to conform to Contract Documents.
 - (3) The Project Inspector shall observe and monitor all testing and inspection activities required.

The Contractor shall conform with all applicable laws as indicated in the Contract Documents, including, without limitation, to CCR, Part 1, Title 24, Section 4-343. The Contractor shall supervise and direct the Work and maintain a competent superintendent on the job who is authorized to act in all matters pertaining to the Work. The Contractor's superintendent shall also inspect all materials, as they arrive, for compliance with the Contract Documents. Contractor shall reject defective Work or materials immediately upon

delivery or failure of the Work or material to comply with the Contract Documents. The Contractor shall submit verified reports as indicated in the Contract Documents, including, without limitation, the Specifications and as required by Part 1, Title 24, Section 4-336.

1.04 TESTING AGENCIES:

- A. Testing agencies and tests shall be in conformance with the General Documents and the requirements of Part 1, Title 24, Section 4- 335.
- B. Testing and inspection in connection with earthwork shall be under the direction of the District's consulting soils engineer, if any, referred to hereinafter as the "Soils Engineer."
- C. Testing and inspection of construction materials and workmanship shall be performed by a qualified laboratory, referred to hereinafter as the "Testing Laboratory." The Testing Laboratory shall be under direction of an engineer registered in the State of California, shall conform to requirements of ASTM E329, and shall be employed by or in contract with the District.

1.05 TESTS AND INSPECTIONS:

- A. The Contractor shall be responsible for notifying the District and Project Inspector of all required tests and inspections. Contractor shall notify the District and Project Inspector at least seventy-two hours (72) hours in advance of performing any Work requiring testing or inspection.
- B. The Contractor shall provide access to Work to be tested and furnish incidental labor, equipment, and facilities to facilitate all inspections and tests.
- C. The District will pay for first inspections and tests required by the "CCR", and other inspections or tests that the District and/or the Architect may direct to have made, including the following principal items:
 - (1) Tests and observations for earthwork and paving.
 - (2) Tests for concrete mix designs, including tests of trial batches.
 - (3) Tests and inspections for structural steel work.
 - (4) Tests and inspections for Adhered Masonry Veneer.
 - (5) Tests and inspections for PV panel attachments to standing seam metal roof.
 - (6) Additional tests directed by the District that establish that materials and installation comply with the Contract Documents.
 - (7) Tests and observations of welding and expansion anchors.
- D. The District may at its discretion, pay and then back charge the Contractor for:
 - (1) Retests or reinspections, if required, and tests or inspections required due to Contractor error or lack of required identifications of material.
 - (2) Uncovering of work in accordance with Contract Documents.
 - (3) Testing done on weekends, holidays, and overtime will be chargeable to the Contractor for the overtime portion.

(4) Testing done off Site.

E. Testing and inspection reports and certifications:

(1) If initially received by Contractor, Contractor shall provide to each of the following a copy of the agency or laboratory report of each test or inspection or certification.

(a) The District;

(b) The Construction Manager, if any;

(c) The Architect;

(d) The Consulting Engineer, if any;

(e) Other engineers on the Project, as appropriate;

(f) The Project Inspector; and

(g) The Contractor.

(2) When the test or inspection is one required by the CCR, a copy of the report shall also be provided to the DSA.

PART 2 - PRODUCTS

2.01 TYPE OF TESTS AND INSPECTIONS

A. Testing and inspection shall be in accordance with DSA Form 103

PART 3 - EXECUTION Not Used.

END OF DOCUMENT

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) and the Division of the State Architect (DSA).
- B. Related Requirements:
 - 1. Section 03 2000 – Concrete Reinforcing.
 - 2. Section 03 3000 – Cast-in-Place Concrete.
 - 3. ~~Section 05 1200 – Structural Steel Framing.~~
 - 4. Section 31 2319 – Excavation Fill for Structures.
 - 5. Detail 18 and General Notes on MODULAR BUILDING MFR. sheet A5.9A-A, for Masonry Veneer Wall Application.
 - 6. TMS 602 Specification for Masonry Structures. (TMS = The Masonry Society)

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
- B. American Institute of Steel Construction (AISC):
 - 1. AISC 360 – Specification for Structural Steel Buildings.
 - 2. AISC 341 – Seismic Provisions for Structural Steel Buildings.
- C. ASTM International (ASTM):
 - 1. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

2. ASTM A370 – Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
3. ASTM A706 – Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
4. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
5. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
6. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
7. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.
8. ASTM E488 - Standard Test Methods for Strength of Anchors in Concrete Elements.
9. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
10. ASTM E1444 - Standard Practice for Magnetic Particle Testing.
11. ASTM F606 - Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets.
12. ASTM C1823 Standard Test Method for Shear Bond Strength of Adhered Dimension Stone (eg- Brick Veneer).

D. Association of the Wall and Ceiling Industry (AWCI):

1. AWCI Technical Manual 12-B - Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide.

E. American Welding Society (AWS):

1. AWS D1.1 – Structural Welding Code.
2. AWS D1.3 – Structural Welding Code – Sheet Steel.
3. AWS D1.4 – Structural Welding Code – Reinforcing Steel.
4. AWS D1.8 – Structural Welding Code – Seismic Supplement.

- F. Division of the State Architect (DSA) Interpretation Regulations (IR):
1. DSA IR 17-2 – Nondestructive Testing (N.D.T.) of Welds.
 2. DSA IR 17-3 – Structural Welding Inspection.
 3. DSA IR 17-8 – Sampling and Testing of High Strength Bolts, Nuts and Washers.
 4. DSA IR 17-9 – High Strength Bolting Inspection.
 5. DSA IR 17-10 – Sampling, Testing and Tagging of Reinforcing Bars.
 6. DSA IR 17-11 – Identification, Sampling and Testing of Threaded Steel Anchor Bolts and Anchor Rods.

1.03 REGULATORY REQUIREMENTS

- A. Laboratories performing testing shall have DSA's Laboratory Evaluation and Acceptance Program approval prior to providing material testing or special inspection services.
- B. Tests of materials and inspections shall be in accordance to Section 4-213 through 4-219 of the California Building Standards Commission's, California Administrative Code.
- C. Required material testing, inspections and special inspections are indicated on the DSA approved DSA-103, Listing of Structural Tests & Special Inspections (T&I List). OWNER will provide CONTRACTOR copy of DSA-103.

1.04 TESTS

- A. OWNER will contract with a DSA approved testing laboratory to perform the testing indicated on the Contract Documents, including the Tests and Special Inspections (T&I) list.
- B. Selection of material to be tested shall be by the Testing Laboratory and not by CONTRACTOR.
- C. 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 Project Inspector such testing and inspection is not required, shall not be incorporated into the Work.

- D. OWNER will select, and directly reimburse, the Testing Laboratory for costs of all DSA required tests and inspections; however, the Testing Laboratory may be reimbursed by CONTRACTOR for such costs as specified or noted in related sections of the Contract Documents.
- E. The Testing Laboratory is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
- F. The Testing Laboratory shall not perform any duties of CONTRACTOR.
- G. 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.

1.05 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 Contract Documents. Test reports shall indicate specified design strength and specifically state whether or not the material (or materials) tested comply with the specified requirements.

1.06 VERIFICATION OF TEST REPORTS

- A. Each Testing Laboratory 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.

1.07 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. OWNER 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.

1.08 PROJECT INSPECTOR

- A. A Project Inspector will 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 Special Inspectors may be employed and assigned to the Work by OWNER in accordance with the requirements of the CBC and DSA.
- 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.

1.09 STRUCTURAL TESTS AND SPECIAL INSPECTIONS

- A. All Structural Tests and Special Inspections listed are minimum requirements. Refer to DSA 103 for additional requirements.
- B. Soils:
 - 1. General: Periodic inspection by Geotechnical Engineer for verification of the following construction activities in conformance to CBC Table 1705A.6:
 - a. Site has been prepared properly prior to placement of controlled fill and/or excavations for foundations.
 - b. Foundation excavations are extended to proper depth and have reached proper material.
 - c. Materials below footings are adequate to achieve the design bearing capacity.

2. Compacted Fills: Testing and inspections shall be in conformance to Table 1705A.6:
 - a. Geotechnical Engineer will continuously verify the use of proper materials and inspect lift thicknesses, placement, and compaction during placement of fill.
 - b. Testing Laboratory under the supervision of the Geotechnical Engineer will:
 - 1) Perform qualification testing of fill materials.
 - 2) Test the compaction of fill.
3. Retaining Walls:
 - a. Continuous inspections by Geotechnical Engineer:
 - 1) Placement, compaction and inspection of soil per CBC Section 1705A.6.1 for fills supporting foundations.
 - b. Concrete Retaining Walls: Provide tests and inspections as indicated on paragraphs below for concrete.

C. Concrete:

1. Cast in Place Concrete: Inspection and testing in conformance to CBC Table 1705A.3:
 - a. Inspection of reinforcement, including prestressing tendons and verification of placement, per ACI 318, sections 25.2, 25.3, 25.5.1 26.6.1 – 26.6.3, 26.13.1, 26.13.3.2, 26.13.3.3.
 - b. Reinforcing bar welding: Inspect per AWS D1.4, ACI 318 18.2.8, 25.5.7, 26.6.4, 26.13.1.4, 26.13.3.2, 26.13.3.3.
 - 1) Verification of weldability of reinforcing bars other than ASTM A706.
 - 2) Inspect single-pass fillet welds, maximum 5/16”.
 - 3) Inspect all other welds.
 - c. Inspect anchors cast in concrete per ACI 318, section 17.8.2.
 - d. Inspect anchors post-installed in hardened concrete members:

- 1) Continuous inspection of adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads, per ACI 318, section 17.8.2.4.
 - 2) Mechanical anchors and adhesive anchors, not defined in previous paragraph, per ACI 318, section 17.8.2.
- e. Design Mix:
- 1) Verify use of required mix, per ACI 318, chapter 19 and sections 26.4.3 and 26.4.4.
 - 2) Batch Plant Inspection: The quality and quantity of materials used in transit-mixed concrete and in batched aggregates shall be continuously inspected as required by CBC section 1705A.3.2. If approved by DSA, batch plant inspection may be reduced to periodic if plant complies with CBC section 1705A.3.3.1, item 1, and requires first batch inspection, weightmaster, and batch tickets.
- f. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete, per ASTM C172, ASTM C31, ACI 318, sections 26.4.5 and 26.12.
- g. Inspect concrete and shotcrete placement for proper application techniques, per ACI 318, section 26.4.5.
- h. Verify maintenance of specified curing temperature and techniques per ACI 318 sections 26.4.7 through 26.4.9 and CBC section 1908.9.
- i. Sampling and testing of reinforcing steel per ASTM A370, DSA IR 17-10 and CBC section 1910A.2. CONTRACTOR shall submit mill certificate indicating compliance with requirements for reinforcement, anchors, ties, and metal accessories.
2. Post-installed Anchors:
- a. Special Inspector will inspect installation of post-installed anchors in hardened concrete members as required by CBC table 1705A.3, item 4.
- 1) Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads, per ACI 318, section 17.8.2.4.

- 2) Mechanical anchors and adhesive anchors not defined above, per ACI 318, section 17.8.2.
 - b. Testing Laboratory will test post-installed anchors in conformance to CBC section 1905A and ASTM E488.
- D. Masonry Veneer:
 - 1. Test or Special Inspection:
 - a. Verify proportions of site prepared mortar and grout and/or verify certification of premixed mortar.
 - b. Inspect placement of units and construction of mortar joints.
 - c. Test adhered veneer bond strength.
- E. Structural Steel:
 - 1. Special inspector will verify that all materials are properly marked in conformance with AISC 360, Section 3.3 and applicable ASTM standards.
 - a. Mill certificates indicating material properties that comply with requirements.
 - b. Materials, sizes, types and grades complying with requirements.
 - 2. Testing Laboratory will test unidentified materials in conformance with ASTM A370.
 - 3. Special inspector will examine seam welds of HSS shapes in conformance with DSA IR-17-3.
 - 4. Special inspections and non-destructive testing of structural steel elements shall be in conformance to CBC section 1705A.2.1.
- F. Welding:
 - 1. Verification of Materials, Equipment and Welders:
 - a. Special inspector will verify weld filler material identification markings per AWS designation listed on the Contract Documents and the WPS.
 - b. Special inspector will verify material manufacturer's certificate of compliance.

- c. Special inspector will verify WPS, welder qualifications and equipment in conformance to DSA IR 17-3.
- 2. Shop Welding: Special inspector will inspect the following, per CBC 1705A.2.1, AISC 360 (and AISC 341, as applicable) and DSA IR 17-3:
 - a. Groove, multi-pass fillet welds larger than 5/16", plug and slot welds.
 - b. Single-pass fillet welds equal or less than 5/16".
- 3. Field Welding: Special inspector will inspect the following, per CBC 1705A.2.1, AISC 360 (and AISC 341, as applicable) and DSA IR 17-3:
 - a. Groove, multi-pass fillet welds larger than 5/16", plug and slot welds.
 - b. Single-pass fillet welds equal or less than 5/16".
- 4. Non-Destructive Testing: Testing Laboratory will test perform ultrasonic and magnetic particle testing in conformance to AISC 360 section N5.5, AISC 341 appendix Q5.2, AWS D1.1, AWS D1.8, ASTM E543, ASTM E1444, ASTM E164 and DSA IR 17-2.

G. Anchor Bolts, Anchor Rods and Other Steel:

- 1. Testing Laboratory will sample and test not readily identifiable anchor bolts and anchor rods in accordance with DSA IR 17-11.

PART 2 – PRODUCTS (Not used).

PART 3 – EXECUTION (Not used).

END OF SECTION

ENVIRONMENTAL IMPORT / EXPORT MATERIAL TESTING

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section specifies the requirements for the sampling, testing, transportation and certification of imported fill materials or exported fill materials from La Cañada Unified School District (“LCUSD”) Sites.
- B. This Section defines:
 - 1. Contractor requirements for use of existing, imported or generated materials on LCUSD Sites.
 - 2. Contractor requirements for stockpiling materials for use on school sites.
 - 3. Contractor requirements for exporting materials from a school site including transportation.
 - 4. Testing requirements for all materials imported, exported, stockpiled or generated for use on the school site.
 - 5. Testing and reporting requirements.
 - 6. Contractor submittal requirements.

1.02 RELATED SECTIONS

- A. General Conditions.
- B. Section 01 11 00: Summary of Work.
- C. Section 01 31 13: Project Coordination.
- D. Section 01 32 13: Construction Schedule.
- E. Section 01 32 29: Project Forms
- F. Section 01 33 00: Submittal Procedures.
- G. Section 31 22 00: Grading.
- H. Section 31 23 00: Excavation and Fill.
- I. Section 31 23 16: Excavation and Fill. (Pavement)
- J. Section 31 23 19: Excavation and Fill (Structures).
- K. Section 31 23 23: Excavation and Fill (Utilities).
- L. Section 32 11 00: Base Course.

1.03 OBJECTIVES

- A. Ensure that fill materials imported to LCUSD Sites are free of known and expected environmental contaminants for students, staff, and visitors.
- B. Ensure that materials exported from LCUSD Sites comply with California Code of Regulations (CCR) Title 22 requirements.

- C. Ensure that representative data be collected so that analytical determinations can be made in regards to the first two objectives.

1.04 SUBMITTALS

- A. Contractor shall submit to District Representative for transmittal to District Representative or LCUSD Environmental Consultant if any
 - 1. Written notification in the form of a memo or e-mail from the Contractor to the District Representative is required prior to the importing of soils from a borrow site to a school site. All hauling contracts must specify the use of “clean” trucks. Clean trucks shall be clean of any and all visible contamination or deleterious materials.
 - 2. Written documentation confirming that the trucks traveled 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/export activities. It is the Contractor’s responsibility to document that no other trips or short load augmentation occurred and submit the documentation within seven (7) calendar 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.
 - 3. The Contractor at its expense shall have the required tests performed and report results noting if the tested material passed or failed and shall furnish copies to the District Representative, and/or others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer or professional geologist and the material was tested in accordance with applicable provisions of the Contract Documents, DSA, and CCR Title 22.
 - 4. Certification, in the form of haul tickets or completed waste manifests, documenting the volume/weight and recipient of all import/export materials and activities. This documentation shall be coordinated through the District Representative and LCUSD Environmental Consultant if any. Contractor shall provide, track, and maintain a log of all imported and exported materials.
 - 5. Specific Import Requirements:
 - a. Within thirty (30) calendar days of receipt of Notice to Proceed, the contractor shall submit a spreadsheet listing all required import material types including but not limited to backfill soil, sand, gravel, and crushed aggregate base. The list shall include estimated volumes/weights required by each subcontractor and the intended borrow site locations each contractor intends to procure material from.
 - b. Prior to the import of material, the Contractor must submit to the District a “Import Materials Borrow Site – Approval Form” a minimum of two (2) weeks prior to needing material on site. The Import Materials Borrow Site – Approval Form is included at the end of this Specification Section.
 - c. For import to the school project site, haul tickets shall be utilized, and shall contain the following minimum information:
 - 1) Date(s) of haul activity.
 - 2) Address of source site.

- 3) Address of recipient.
- 4) Load volume/weight.
- 5) Day of departure from source.
- 6) Day of arrival at recipient site.
- 7) Signature of recipient or recipient's agent.
- 8) It is the Contractor's responsibility to confirm that no other trips or short-load augmentation occurred and submit documentation to the District Representative.

1.05 APPROVALS

- A. Import of soil, granular base, geotechnical grading or filling materials at LCUSD sites will occur only with prior approval of the District through the District Representative.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Imported:
 1. Soils: Soils proposed for import shall be tested pursuant to the requirements as outlined in Part 3 of this Section.
 2. Gravels/CAB: Clean gravel, consisting of native rock from a commercial source, shall be tested pursuant to the requirements of this Section.
 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/weight and proposed transport date(s) of the material for review.
 4. Miscellaneous Material: **No crushed miscellaneous material (CMB) containing potential deleterious materials may be utilized or imported to a LCUSD project site for use as fill or grading material.**

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 the District Representative, cease work at the aforementioned area(s), and secure the area(s) with fencing, tape, stakes or other suitable means to prevent entry by personnel or equipment. Upon notification, the District Representative will immediately notify the LCUSD Environmental Consultant, which will initiate a construction response to address the area(s) of concern, in accordance with pertinent regulatory requirements.

3.02 SAMPLING AND TESTING

- A. All import material testing will be performed by a testing laboratory selected by the Contractor and approved by the District. Contractor must coordinate with the District per Item 1.04, of this Section, to request approval of borrow site.

- B. All fill/grading material must be tested at the site of origin. Import testing and certification process shall include the steps listed below. OWNER retains the right to refuse any fill material proposed for use at any LCUSD site.
1. Stockpile all materials for sampling (standard stockpile or backhoe pothole stockpile). Crushed fill materials generated by Contractor at a LCUSD site must be segregated by material type (e.g., separate stockpiles for concrete, asphalt, etc. – not to be tested).
 2. Provide completed Request for Import Fill Material Testing form, per Item 1.04.A.1.
- C. Import fill materials shall be stockpiled by Contractor (or the export site) and will be deemed acceptable for import/export or reuse only when it has been tested and proven clean to the satisfaction of the District.
- D. Import fill material may be deemed defective for use by the District or its Environmental Consultant, if any at a LCUSD site should any of the following compounds or chemicals exceed the prescribed volumes:
1. TPH are present at concentrations exceeding 100 milligrams per kilogram (mg/kg) for gasoline and/or 1,000 mg/kg for oil/diesel and long-chain hydrocarbons.
 2. Solvents and other VOCs are present at concentrations exceeding the human health risk levels for unrestricted land use and/or hazardous waste characterization criteria whichever is lower.
 3. PCBs are present at concentrations exceeding the human health risk levels for unrestricted land use and/or hazardous waste characterization criteria whichever is lower.
 4. SVOCs are present at concentrations exceeding the human health risk levels for unrestricted land use and/or hazardous waste characterization criteria whichever is lower.
 5. OCPs are present at concentrations exceeding the human health risk levels for unrestricted land use and/or hazardous waste characterization criteria whichever is lower.
 6. OPPs are present at concentrations exceeding the human health risk levels for unrestricted land use and/or hazardous waste characterization criteria whichever is lower.
 7. Chlorinated herbicides are present at concentrations exceeding the human health risk levels for unrestricted land use and/or hazardous waste characterization criteria whichever is lower.
 8. California Code of Regulations Title 22 (CAM 17) Metals at concentrations exceeding human health risk levels for unrestricted land use or typical background levels expected in California and/or hazardous waste characterization criteria whichever is lower.
 9. Hexavalent chromium is present at concentrations exceeding 17 mg/kg or failing hazardous waste STLC leachate criteria.
- E. All export/import material shall be characterized, handled, and documented in accordance with applicable US EPA and State of California hazardous waste and hazardous materials regulations. For the purpose of this specification, “contaminated” shall mean any soil or geotechnical material with constituent concentrations, which would require disposal at a

permitted facility (i.e., California hazardous or RCRA hazardous). District Representative must be notified at least five days prior to the disposal of any hazardous waste or hazardous material. No material disposal or reuse can take place without prior written approval of District Representative.

- F. Specification test results and LCUSD approvals shall be valid for a period of 90 days from the date of the subject testing. Previously approved materials shall not be utilized after the 90-day limit without prior review and approval by the District's Environmental Consultant.

3.03 TRANSPORTATION

- A. Details of the samples and testing must be submitted to and approved by LCUSD Environmental Consultant before the materials from which the samples were collected undergo transportation.
- B. Haul Routes and Regulations/Restrictions: Contractor must comply with requirements of project environmental disclosure documents (i.e., CEQA EIR) and authorities having jurisdiction over the project area and the proposed activities (e.g. Regional Water Quality Control Board, Orange County Health Care Agency, DTSC, etc.).

3.04 COSTS

- A. Contractor shall pay the costs of testing materials borrow sites.
- B. Contractor shall pay all fees associated with loading, hauling and disposal of exported soil and aggregates. Should contaminated soil otherwise not identified in the contractor documents be encountered, the district shall pay the fee difference for disposal if the soil is determined to be treated as a hazardous material.
- C. Contractor shall pay all fees for loading, hauling, disposal and/or processing of contaminated and/or hazardous fill materials identified in the contract documents.

END OF SECTION 01 45 24

IMPORT MATERIALS BORROW SITE - APPROVAL FORM

Date:	
Project Name:	
Contractor:	
School Site Receiving Import	

Location of Soil Borrow Site:

Borrow Site Address:	
Borrow Site City:	
Major Cross Streets:	

Soil Owner Information:

Soil Owner Name:	
Contact Name:	
Contact Phone Number:	

Site History:

Describe Current Site Use:	
Describe Site History:	
Available Environmental Documents:	

Borrow Soil Description:

Material Type:	☐ Fill Soil ☐ Other: _____
Import Soil Volume:	_____ (Tonnage)
If in place material, depth and acres of excavation: _____	
☐ Only portion of material is available or ☐ All required material is available ☐ Stockpile or ☐ In Place	
Materials already on Import Site?	☐ Yes ☐ No

Schedule:

Date when materials are needed:	
Date of Test	

Comments:

Contractor Signature: _____

Approved by District Representative: _____

PARADISE CANYON ELEMENTARY SCHOOL

PACKAGE 5 – NEW NORTH BUILDINGS

5/15/2023
ENVIRONMENTAL IMPORT/EXPORT TESTING
01 45 24-6

TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions;
- C. Site Standards; and
- D. Construction Waste Management and Disposal.

1.02 TEMPORARY UTILITIES:

A. Electric Power and Lighting:

- (1) Contractor shall provide temporary power during the course of the Work. To the extent power is available in the building(s) or on the Site, Contractor may use the District's existing utilities. Contractor shall be responsible for providing temporary facilities required to deliver that power service from its existing location on the Site, or off-site to point of intended use.
- (2) Contractor shall verify characteristics of power available in building(s) or on the Site. Contractor shall take all actions required to make modifications where power of higher voltage or different phases of current are required. Contractor shall be fully responsible for providing that service and shall pay all costs required therefor.
- (3) Contractor shall furnish, wire for, install, and maintain temporary electrical lights wherever it is necessary to provide illumination for the proper performance and/or observation of the Work: a minimum of 20 foot-candles for rough work and 50 foot-candles for finish work.
- (4) Contractor shall be responsible for maintaining existing lighting levels in the project vicinity should temporary outages or service interruptions occur.
- (5) Contractor is advised that portion of the site will be in used during the construction of the improvement. Contractor shall ensure that electrical power, lighting is not interrupted in spaces or facilities occupied by the District during the construction work.

B. Heat and Ventilation:

- (1) Contractor shall provide temporary heat to maintain environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation and curing of materials, and to protect materials and finishes from damage due to improper temperature and humidity conditions. Portable heaters shall be standard units complete with controls.
- (2) Contractor shall provide forced ventilation and dehumidification, as required, of enclosed areas for proper installation and curing of materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, and gases.
- (3) Contractor shall pay the costs of installation, maintenance, operation, and removal of temporary heat and ventilation, including costs for fuel consumed, required for the performance of the Work.

C. Water:

- (1) To the extent water is available on the Site, Contractor may use the District's existing utilities. Contractor shall be responsible for providing temporary facilities required to deliver such utility service from its existing location on the Site, or other location approved by the local water agency, to point of intended use.
- (2) Contractor shall use backflow preventers on water lines at point of connection to District's water supply. Backflow preventers shall comply with requirements of Uniform Plumbing Code.
- (3) Contractor shall make potable water available for human consumption.

D. Sanitary Facilities:

- (1) Contractor shall provide sanitary temporary facilities in no fewer numbers than required by law and such additional facilities as may be directed by the Inspector for the use of all workers. The facilities shall be maintained in a sanitary condition at all times and shall be left at the Site until removal is directed by the Inspector or Contractor completes all other work at the Site.
- (2) Use of toilet facilities in the Work under construction shall not be permitted except by consent of the Inspector and the District.

E. Telephone Service:

- (1) Contractor shall arrange with local telephone service company for telephone service as required for the performance of the Work. Contractor shall, at a minimum, provide in its field office one line for telephone and one line for fax machine.
- (2) Contractor shall pay the costs for telephone and fax lines installation, maintenance, service, and removal.

F. Fire Protection:

- (1) Contractor shall provide and maintain fire extinguishers and other equipment for fire protection. Such equipment shall be designated for use for fire protection only and shall comply with all requirements of the California Fire, State Fire Marshall and/or its designee.
- (2) Where on-site welding and burning of steel is unavoidable, Contractor shall provide protection for adjacent surfaces.

G. Trash Removal:

- (1) Contractor shall provide trash removal on a timely basis. Under no circumstance shall Contractor use District trash service.

H. Contractor's Field Office:

- (1) If Contractor chooses to provide a field office, it shall be an acceptable construction trailer that is well-lit and ventilated. The construction trailer shall be equipped with shelves, desks, filing cabinet, chairs, and such other items of equipment needed. Trailer and equipment are the property of the Contractor and must be removed from the Site upon completion of the Work. Location of trailer shall be approved by the District.
- (2) Contractor shall provide any additional electric lighting and power required for the trailer. Contractor shall make adequate provisions for heating and cooling as required.

1.03 CONSTRUCTION AIDS:

A. Plant and Equipment:

- (1) Contractor shall furnish, operate, and maintain a complete plant for fabricating, handling, conveying, installing, and erecting materials and equipment; and for conveyances for transporting workers. Include elevators, hoists, debris chutes, and other equipment, tools, and appliances necessary for performance of the Work.
- (2) Contractor shall maintain plant and equipment in safe and efficient operating condition. Damages due to defective plant and equipment, and uses made thereof, shall be repaired by Contractor at no expense to the District.

B. None of the District's tools and equipment shall be used by Contractor for the performance of the Work.

1.04 BARRIERS AND ENCLOSURES:

- A. Contractor shall obtain the District's written permission for locations and types of temporary barriers and enclosures, including fire-rated materials proposed for use, prior to their installation.
- B. Contractor shall provide and maintain temporary enclosures to prevent public entry and to protect persons using other buildings and portions of the Site and/or Premises, the public, and workers. Contractor shall also protect the Work and existing facilities from the elements, and adjacent construction and improvements, persons, and trees and plants from damage and injury from demolition and construction operations.
- C. Contractor shall provide site access to existing facilities for persons using other buildings and portions of the Site, the public, and for deliveries and other services and activities.
- D. Tree and Plant Protection:
 - (1) Contractor shall preserve and protect existing trees and plants on the Premises that are not designated or required to be removed, and those adjacent to the Premises.
 - (2) Contractor shall provide barriers to a minimum height of 4'-0" around drip line of each tree and plant, around each group of trees and plants, as applicable, in the proximity of demolition and construction operations, or as denoted on the Plans.
 - (3) Contractor shall not park trucks, store materials, perform Work or cross over landscaped areas. Contractor shall not dispose of paint thinners, water from cleaning, plastering or concrete operations, or other deleterious materials in landscaped areas, storm drain systems, or sewers. Plant materials damaged as a result of the performance of the Work shall, at the option of the District and at Contractor's expense, either be replaced with new plant materials equal in size to those damaged or by payment of an amount representing the value of the damaged materials as determined by the District.
 - (4) Contractor shall remove soil that has been contaminated during the performance of the Work by oil, solvents, and other materials which could be harmful to trees and plants, and replace with good soil, at Contractor's expense.
 - (5) Excavation around Trees:
 - (a) Excavation within drip lines of trees shall be done only where absolutely necessary and with written permission from the District.
 - (b) Where trenching for utilities is required within drip lines, tunneling under and around roots shall be by hand digging and shall be approved by the District. Main lateral roots and taproots shall not be cut. All roots 2 inches in diameter and larger shall be tunneled under and heavily wrapped with wet burlap so as to prevent scarring or excessive drying. Smaller roots that interfere with installation of new work may be cut with prior approval by the District. Roots must first be cut with a Vermeer, or equivalent, root cutter prior to any trenching.

- (c) Where excavation for new construction is required within drip line of trees, hand excavation shall be employed to minimize damage to root system. Roots shall be relocated in backfill areas wherever possible. If encountered immediately adjacent to location of new construction, roots shall be cut approximately 6 inches back from new construction.
- (d) Approved excavations shall be carefully backfilled with the excavated materials approved for backfilling. Backfill shall conform to adjacent grades without dips, sunken areas, humps, or other surface irregularities. Do not use mechanical equipment to compact backfill. Tamp carefully using hand tools, refilling and tamping until Final Acceptance as necessary to offset settlement.
- (e) Exposed roots shall not be allowed to dry out before permanent backfill is placed. Temporary earth cover shall be provided, or roots shall be wrapped with four layers of wet, untreated burlap and temporarily supported and protected from damage until permanently relocated and covered with backfill.
- (f) Accidentally broken roots should be sawed cleanly 3 inches behind ragged end.

1.05 SECURITY:

The Contractor shall be responsible for project security for materials, tools, equipment, supplies, and completed and partially completed Work.

1.06 TEMPORARY CONTROLS:

A. Noise Control:

- (1) Contractor acknowledges that adjacent facilities will remain in operation during a portion of the Work period, and it shall take all reasonable precautions to minimize noise as required by applicable laws and the Contract Documents.
- (2) Notice of proposed noisy operations, including without limitation, operation of pneumatic demolition tools, concrete saws, and other equipment, shall be submitted to the District a minimum of forty-eight (48) hours in advance of their performance.
- (3) Refer to Section 01 41 11 CEQA Mitigation Measures for additional requirements.
 - (a) Furnish and Install Acoustical Curtain/Sound Blanket.
 - i. Contractor shall furnish and install acoustical curtain/sound blanket on 8-foot chain link fence where indicated on the fencing plan (Refer to the Special Conditions) and, as required per Section 01 41 11.

- ii. Product shall be exterior grade, UV resistant heavy-duty faced quilted fiberglass absorber bonded to a reinforced loaded vinyl barrier.
- iii. The quilted blanket shall be configured as hanging panels.
- iv. Curtain panels shall be constructed with grommets across the top and bottom and exterior grade Velcro seals along the vertical edges.
- v. Panel size: 46" (w) x 96" (h) nominal.
- vi. Blankets shall meet the following minimum criteria:
 - NRC: 0.75
 - STC: 25
 - Temperature range: -20 degrees to 180 degrees Fahrenheit
 - ASTM E84 Class 1 or A Fire Rating
- vii. Panels shall be secured on fence with zip-ties. Fence panels and posts shall be constructed, erected and secured adequately to withstand prevailing winds in the area. Fence and noise blankets shall be maintained throughout the duration of construction and be removed at end of construction.

B. Noise and Vibration:

- (1) Equipment and impact tools shall have intake and exhaust mufflers.
- (2) Contractor shall cooperate with District to minimize and/or cease the use of noisy and vibratory equipment if that equipment becomes objectionable by its longevity.

C. Dust and Dirt:

- (1) Contractor shall conduct demolition and construction operations to minimize the generation of dust and dirt, and prevent dust and dirt from interfering with the progress of the Work and from accumulating in the Work and adjacent areas including, without limitation, occupied facilities.
- (2) Contractor shall periodically water exterior demolition and construction areas to minimize the generation of dust and dirt.
- (3) Contractor shall ensure that all hauling equipment and trucks carrying loads of soil and debris shall have their loads sprayed with water or covered with tarpaulins, and as otherwise required by local and state ordinance.
- (4) Contractor shall prevent dust and dirt from accumulating on walks, roadways, parking areas, and planting, and from washing into sewer and storm drain lines.

D. Water:

- (1) Contractor shall not permit surface and subsurface water, and other liquids, to accumulate in or about the vicinity of the Premises. Should accumulation develop, Contractor shall control the water or other liquid, and suitably dispose of it by means of temporary pumps, piping, drainage lines, troughs, ditches, dams, or other methods.

E. Pollution:

- (1) No burning of refuse, debris, or other materials shall be permitted on or in the vicinity of the Premises.
- (2) Contractor shall comply with applicable regulatory requirements and anti-pollution ordinances during the conduct of the Work including, without limitation, demolition, construction, and disposal operations.

F. Lighting:

- (1) If portable lights are used after dark, all light must be located so as not to direct light into neighboring property.

1.07 JOB SIGN(S):

A. General:

- (1) Contractor shall provide and maintain a Project identification sign with the design, text, and colors designated by the District and/or the Design Professional; locate sign as approved by the District.
- (2) Signs other than the specified Project sign and or signs required by law, for safety, or for egress, shall not be permitted, unless otherwise approved in advance by the District.

B. Materials:

- (1) Structure and Framing: Structurally sound, new or used wood or metal; wood shall be nominal 3/4-inch exterior grade plywood.
- (2) Sign Surface: Minimum 3/4-inch exterior grade plywood.
- (3) Rough Hardware: Galvanized.
- (4) Paint: Exterior quality, of type and colors selected by the District and/or the Design Professional.

C. Fabrication:

- (1) Contractor shall fabricate to provide smooth, even surface for painting.
- (2) Size: 4'-0" x 8'-0", unless otherwise indicated.

- (3) Contractor shall paint exposed surfaces of supports, framing, and surface material with exterior grade paint: one coat of primer and one coat of finish paint.
- (4) Text and Graphics: As indicated. (See Attached)

1.08 PUBLICITY RELEASES:

- A. Contractor shall not release any information, story, photograph, plan, or drawing relating information about the Project to anyone, including press and other public communications medium, including, without limitation, on website(s) without the written permission of the District.

PART 2 – PRODUCTS Not used.

PART 3 – EXECUTION Not used.

END OF DOCUMENT

Your Measure "LCF" Bond Dollars at Work
**Paradise Canyon Elementary School
Modernization Project**

La Cañada Unified School District Governing Board of Education

CAROLINE ANDERSON

JOSH EPSTEIN

DAN JEFFRIES

JOE RADABAUGH

OCTAVIA THUSS

Superintendent: WENDY SINNETTE

Program Manager: LINIK CORP

Architect: GGA

Contractor: TBD

A special thanks to the La Cañada Flintridge community for supporting this project.

For project related information contact Melissa Greenwood, mgreenwood@lcsd.net.

Project Sign

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Temporary Facilities and Controls.

1.02 SECTION INCLUDES:

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

1.03 DEFINITIONS:

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

1.04 PERFORMANCE REQUIREMENTS:

- A. General: Develop waste management plan that results in end-of Project rates for salvage/recycling of sixty-five percent (65%) by weight (or by volume, but not a combination) of total waste generated by the Work.

1.05 SUBMITTALS:

- A. Waste Management Plan: Submit waste management plan within 30 days of date established for commencement of the Work.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit copies of report. Include the following information:
 - (1) Material category.
 - (2) Generation point of waste.
 - (3) Total quantity of waste in tons or cubic yards.
 - (4) Quantity of waste salvaged, both estimated and actual in tons or cubic yards.
 - (5) Quantity of waste recycled, both estimated and actual in tons or cubic yards.
 - (6) Total quantity of waste recovered (salvaged plus recycled) in tons or cubic yards.
 - (7) Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for final payment, submit copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. Qualification Data: For Waste Management Coordinator.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- J. Submittal procedures and quantities are specified in Document 01 33 00.

1.06 QUALITY ASSURANCE:

- A. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council.

- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements. Review methods and procedures related to waste management including, but not limited to, the following:
 - (1) Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - (2) Review requirements for documenting quantities of each type of waste and its disposition.
 - (3) Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - (4) Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - (5) Review waste management requirements for each trade.

1.07 WASTE MANAGEMENT PLAN:

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measurement throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - (1) Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - (2) Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - (3) Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - (4) Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - (5) Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - (6) Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION:

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - (1) Comply with Document 01 50 00 for operation, termination, and removal requirements.
- B. [Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.]
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - (1) Distribute waste management plan to everyone concerned within 3 days of submittal return.
 - (2) Distribute waste management plan to entities when they first begin work on site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - (1) Designate and label specific areas of Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - (2) Comply with Document 01 50 00 for controlling dust and dirt, environmental protection, and noise control.

3.02 RECYCLING CONSTRUCTION WASTE:

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to the Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - (1) Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project Site. Include list of acceptable and unacceptable materials at each container and bin.
 - (a) Inspect containers and bins for contamination and remove contaminated materials if found.
 - (2) Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

- (3) Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - (4) Store components off the ground and protect from the weather.
 - (5) Remove recyclable waste off District property and transport to recycling receiver or processor.
- D. Packaging:
- (1) Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - (2) Polystyrene Packaging: Separate and bag material.
 - (3) Pallets: As much as possible, require deliveries using pallets to remove pallets from Project Site. For pallets that remain on Site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - (4) Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- E. Site-Clearing Wastes: Chip brush, branches, and trees on site.
- F. Wood Materials:
- (1) Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - (2) Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- G. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
- (1) Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.03 DISPOSAL OF WASTE:

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

END OF SECTION

FIELD OFFICES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Temporary Facilities and Controls.

1.02 SECTION INCLUDES:

- A. Requirements for Field Offices and Field Office Trailers.

1.03 SUMMARY:

- A. General: Contractor shall provide District's Field Office Trailer and contents, for District's use exclusively, during the term of the Contract.
- B. Property: Trailer, furniture, furnishings, equipment, and the like, supplied by the Contractor with the Office Trailer shall remain the property of the Contractor; District property items installed, delivered, and the like by District within the Office Trailer will remain District's property.
- C. Modifications: District reserves the right to modify the trailer or contents, or both, as may be deemed proper by District.
- D. Condition: Trailer and contents shall be clean, neat, substantially finished, in good, proper, and safe condition for use, operation, and the like; the trailer and contents shall not be required to be new.
- E. Installation Timing: Provide safe, fully furnished, functional, proper, complete, and finished trailer properly ready for entire use, within fourteen (14) calendar days of District's notification of the issuance of Notice to Proceed.

1.04 SUBMITTALS:

- A. General: Submit submittals to District in quantity, format, type, and the like, as specified herein.
- B. Office Trailer Data: One (1) copy of manufacturer's descriptive data, technical descriptions, regulatory compliance, industry standards, installation, removal, and maintenance instructions.
- C. Equipment Data: Two (2) copies of manufacturer data for each type of equipment, if directed by District.
- D. Furniture and Furnishings Data: Two (2) copies of manufacturer data for each type of equipment, if directed by District.

- E. Plans: One (1) reproducible copy of appropriately scaled plans of trailer layout. Plans shall include, but not be limited to: lighting; furniture; equipment; telephone and electrical outlets; and the like.
- F. Product Samples: One (1) complete and entire unit of each type, if directed by District.

1.05 QUALITY ASSURANCE

- A. Standards: In the event that provisions of codes, regulations, safety orders, Contract Documents, referenced manufacturer's specifications, manufacturer's instructions, industry standards, and the like, are in conflict, the more restrictive and higher quality shall govern.
- B. Installer: Installer or Installers engaged by Contractor must have a minimum of five (5) years of documented and properly authenticated successful experience of specialization in the installation of the items or systems, or both, specified herein.
- C. Manufacturer: Contractor shall obtain products from nationally and industry recognized Manufacturer with five (5) years minimum, of immediately recent, continuous, documented and properly authenticated successful experience of specialization in the manufacture of the product specified herein.
- D. State Personnel Training: Provide proper training for maintenance and operations, including emergency procedures, and the like, as directed by District.
- E. Units: Shall be sound and free of defects, and shall not include any damage or defect that will impair the safety, installation, performance, or the durability of the entire Office Trailer and appurtenant systems.

1.06 REGULATORY REQUIREMENTS

- A. General: Work shall be executed in accordance with applicable Codes, Regulations, Statutes, Enactments, Rulings, Laws, each authority having jurisdiction, and including, but not limited to, Regulatory Requirements specified herein.
- B. California Building Standards Code ("CBSC").
- C. California Code of Regulations, Title 25, Chapter 3, Sub Chapter 2, Article 3 ("CCR").
- D. Coach Insignia: Trailer shall display California Commercial Coach Insignia; such insignia shall be deemed to show that the trailer is in accordance with the Construction and Fire Safety requirements of CCR.

PART 2 – PRODUCTS

2.01 FIELD OFFICE TRAILER

- A. General: Provide entire Field Office Trailer of type, function, operation, capacity, size, complete with controls, safety devices, accessories, and the like, for proper and durable installation. Partitions, walls, ceiling, and other interior and exterior surfaces shall be appropriately finished, including, but not limited to, trim, painting, wall base, floor covering, suspended or similar ceiling, and the like; provide systems, components, units, nuts, bolts, screws, anchoring devices, fastening devices, washers, accessories, adhesives, sealants, and other items of type, grade, and class required for the particular use, not identified but required for a complete, weather-tight, appropriately operating, and finished installation.

- B. Manufacturers: General Electric Capital Modular Space; The Space Place, Inc.; or equal.
- C. Program: Provide a wheel-mounted trailer with stairs, landings, platforms, ramps, and the like, in good, proper, safe, clean, and properly finished condition; with proper heavy duty locks, and other proper and effective security at all doors, windows, and the like. Trailer shall be maintained in good, proper, safe, clean, and properly finished condition during the Contract.
- (1) Nominal Trailer Size (12 ft x 40 ft): four hundred eighty (480) square feet, minimum.
 - (2) Stairs, Platform: Properly finished stairs, platforms, and ramps.
 - (3) Doors: Two (2), three (3) foot wide exterior doors with locksets; finished ramp, steps, and entry platform at each exterior door.
 - (4) Private offices: Two (2) 12 x 10 ft offices with door.
 - (5) Keys: Submit three (3) keys for each door, window, furniture unit, and the like. There shall be no other key copies or originals available; each key shall be identified for District; and shall be labeled, or tagged or both, as directed by District.
 - (6) HVAC: Provide package unit for heating and cooling.
 - (7) Lighting: Sixty-five (65) foot-candles illumination minimum at any point, at thirty (30) inches above finished floor throughout from fluorescent light source, exclusively, or as directed by District.
 - (8) Electrical Outlets: One (1) duplex outlet evenly spaced every twelve (12) linear horizontal feet of wall face, and electrical service ready for use. Minimum one receptacle at each wall.

2.02 ADDITIONAL ITEMS

- A. Furniture and Equipment: Provide in the space located to effect efficient and logical use.
- (1) File cabinet: One (1); four (4) drawer; lateral; steel locking.
 - (2) Plan Table: One (1) plan table: thirty-six (36) inches deep by seventy-two (72) inches wide by forty-two (42) inches high; adjustable; wood or steel; with lockable plan and pencil drawers.
 - (3) Drafting Stool: One (1) drafting stool; swiveling; steel; padded; adjustable; with footrest and casters.
 - (4) Plan Rack: One (1) wheel mounted plan rack.
 - (5) Waste Baskets: One (1) large waste basket.
 - (6) Portable Toilets: One (1); each shall include a urinal; each unit shall be a properly enclosed chemical unit conforming to ANSI Z4.3.
 - (a) Location: As directed by District.
 - (b) Maintenance: Maintain each unit and surrounding areas in a clean, hygienic and orderly manner, at all time. Empty, clean, and sanitize each unit each day at a location and time as directed by District.

- (c) Removal: Relocate, or remove from the site, each Portable Toilet. Upon such directive by District, the Contractor shall forthwith relocate or remove each Portable Toilet and submit the affected areas to a condition which existed prior to the installation of each Portable Toilet, within three (3) calendar days, or as directed by District in writing, at no cost to District.

2.03 UTILITY AND SERVICES

- A. Electrical Service: Provide all proper connections for service for the duration of the Work.

2.04 FINISHES

- A. General: Manufacturer standard finish system over surfaces properly cleaned, pretreated, and prepared to obtain proper bond; all visible surfaces shall be coated.
- B. Finish: Color as selected by District from manufacturer standard palette.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. General: Properly prepare area and affected items to receive the Work. Set Work accurately in location, alignment, and elevation; rigidly, securely, and firmly anchor to appropriate structure; install plumb, straight, square, level, true, without racking, rigidly anchored to proper solid blocking, substrate, and the like; provide appropriate type and quantity of reinforcements, fasteners, adhesives, self-adhesive and other tapes; lubricants, coatings, accessories, and the like, as required for a complete, structurally rigid, stable, sound, and appropriately finished installation, in accordance with manufacturer's published instructions, and as indicated. The more restrictive and higher quality requirement shall govern. Moving parts shall be properly secured, without binding, looseness, noise, and the like.
- B. Installation: Install in accordance with 25 CCR 3.2.3 and as directed by District; jack up trailer and level both ways; mount on proper concrete piers with all load off wheels; provide required tie down and accessories per Section 4368 of referenced CCR, and as directed by District.
- C. Rejected Work: Work, materials, unit, items, systems, and the like, not accepted by District shall be deemed rejected, and shall forthwith be removed and replaced with proper and new Work, materials, unit, items, systems, and the like at no cost to District.
- D. Standard: Comply with manufacturer's published instructions, or with instructions as shown or indicated; the more restrictive and higher quality requirement shall govern.
- E. Location: As directed by District.
- F. Fire Resistance: Construct and install in accordance with UL requirements.
- G. Maintenance: Contractor shall maintain trailer and adjacent areas in a safe, clean and hygienic condition throughout the duration of the Work, and as directed by District. Properly repair or replace furniture or other items, as directed by District. Properly remove unsafe, damaged, or broken furniture, or similar items, and replace with safe and proper items. Contractor shall pay cost of all services, repair, and maintenance, or replacement of each item.
- H. Janitorial Service: Provide professional janitorial services, including, but not limited to, trash, waste paper baskets, fill paper dispensers; clean and dust all furniture, files, and the like; sweep and mop resilient and similar flooring; and vacuum carpeting and similar flooring.

(1) Frequency: One (1) time per week, minimum.

- I. Removal: Properly remove the Office Trailer and contents from the Site upon completion of the Contract, or as directed by District in writing. Forthwith properly patch and repair affected areas; replace damaged items with new items. Carefully and properly inventory, clean, pack, store, and protect District property; submit District property to District at a date, time and location as directed by District.

END OF DOCUMENT

01 56 39
TREE AND PLANT PROTECTION

PART 1 – GENERAL

1.1 SUMMARY

- A. The scope of work includes all labor, materials, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with protection of existing trees and other plants as shown on the drawings and as specified herein.
 - 1. Provide preconstruction evaluations
 - 2. Provide tree and plant protection fencing.
 - 3. Provide protection of root zones and above ground tree and plants
 - 4. Provide pruning of existing trees and plants.
 - 5. Coordinate with the requirements of Section Planting Soil for modifications to the soil within the root zone of existing trees and plants.
 - 6. Provide all insect and disease control.
 - 7. Provide maintenance of existing trees and plants including irrigation during the construction period as recommended by the arborist report.
 - 8. Provide maintenance of existing trees and plants including irrigation during the post construction plant maintenance period.
 - 9. Remove tree protection fencing and other protection from around and under trees and plants.
 - 10. Clean up and disposal of all excess and surplus material.

1.2 CONTRACT DOCUMENTS

- A. Shall consist of specifications and general conditions and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.
- B. It is the intent of this section that the requirements apply to all sections of the project specification such that any subcontractor must comply with the restrictions on work within designated Tree and Plant Protection Areas.

1.3 REFERENCES

- A. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail.
 - 1. ANSI A 300 (Part 5) – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current editions.
 - 2. Pruning practices shall conform with recommendations “Structural Pruning: A Guide For The Green Industry”; Published by Urban Tree Foundation, Visalia, California; most current edition.
 - 3. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign IL, most current edition.

1.4 VERIFICATION

- A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Owner's

Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner's Representative.

1.5 PERMITS AND REGULATIONS

- A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner's Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.
- B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.
- C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner's Representative shall determine which shall govern.

1.6 PROTECTION OF WORK, PROPERTY AND PERSON

- A. The Contractor shall protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

1.7 CHANGES IN THE WORK

- A. The Owner's Representative may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

1.8 CORRECTION OF WORK

- A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest possible time that can be coordinated with other work and seasonal weather demands.

1.9 DEFINITIONS

All terms in this specification shall be as defined in the "Glossary of Arboricultural Terms" or as modified below.

- A. Owner's Representative: The person appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.
- B. Reasonable and reasonably: When used in this specification is intended to mean that the conditions cited will not affect the establishment or long term stability, health or growth of the plant. This specification recognizes that plants are not free of defects, and that plant conditions change with time. This specification also recognizes that some decisions cannot be totally based on measured findings and that profession judgment is required. In cases of differing opinion, the Owner's Representative expert shall determine when conditions within the plant are judged as reasonable.
- C. Shrub: Woody plants with mature height approximately less than 25 feet.
- D. Tree and Plant Protection Area: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and defined by a circle centered on the trunk with each tree with a radius equal to the crown dripline unless otherwise indicated by the owner's representative.
- E. Tree: Single and multi-stemmed plants, including palms with anticipated mature height approximately greater than 25 feet or any plant identified on the plans as a tree.

1.10 SUBMITTALS

- A. ARBORIST REPORT: Prior to the start of construction, submit, for approval by the Owner's Representative, the report of a consulting arborist who is a registered Consulting Arborist® (RCA) with American Society of Consulting Arborists or an ISA Board Certified Master Arborist, which details the following information for all trees to remain within the area designated on the drawings as the Tree and Plant Protection Area. The report shall include the following:
 - 1. A description of each tree to remain indicating its genus and species, condition including any visible damage to the root system or soil within the root zone, tree diameter at breast height (dbh) and approximate height, size and any visible disease, insect infestations and or branch and trunk structural deficiencies.
 - 2. The report shall note all trees or parts of trees, which are considered a hazard or significant or extreme risk level. Include the International Society of Arboriculture hazard evaluation sheet for each tree, which may reasonably be identified as a potential hazard tree.
 - 3. Recommendations as to treatment of all insect, disease and structural problems encountered.
 - 4. Recommendations for fertilizer treatments, if any.
 - 5. A plan of the site showing the location of all trees included in the report.
- B. PRODUCT DATA: Submit manufacturer product data and literature describing all products required by this section to the Owner's Representative for approval. Provide submittal four weeks before the start of any work at the site.
- C. QUALIFICATIONS SUBMITTAL: For each applicable person expected to work on the project, provide copies of the qualifications and experience of the Consulting arborist, proof of either the registered Consulting Arborist® (RCA) with American Society of Consulting Arborists or an ISA Board Certified Master Arborist and any required Herbicide/Pesticide license to the Owner's Representative, for review prior to the start of work.

1.11 OBSERVATION OF THE WORK

- A. The Owner's Representative may inspect the work at any time.

1.12 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre - construction meeting with the Owner's Representative at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.
 - 1. The following Contractors shall attend the preconstruction conference:
 - a. General Contractor.
 - b. Consulting Arborist.
 - c. Subcontractor assigned to install Tree and Plant Protection measures.
 - d. Earthwork Contractor.
 - e. All site utility Contractors that may be required to dig or trench into the soil.
 - f. Landscape subcontractor.
 - g. Irrigation subcontractor
- B. Prior to this meeting, mark all trees and plants to remain and or be removed as described in this specification for review and approval by the Owner's Representative.

1.13 QUALITY ASSURANCE

- A. Contractor qualifications:
 - 1. All pruning, branch tie back, tree removal, root pruning, and fertilizing required by this section shall be performed by or under the direct supervision of ISA Certified Arborist Submit aforementioned individual's qualifications for approval by the Owner's Representative.
 - 2. All applications of pesticide or herbicide shall be performed by a person maintaining a current state license to apply chemical pesticides valid in the jurisdiction of the project. Submit copies of all required state licensing certificates including applicable chemical applicator licenses.

PART 2 – PRODUCTS

2.1 MULCH

- A. Mulch shall be coarse, ground, from tree and woody brush sources. The minimum range of fine particles shall be 3/8 inch or less in size and a maximum size of individual pieces shall be approximately 1 to 1-1/2 inch in diameter and maximum length of approximately 4 to 8 inches. No more than 25% of the total volume shall be fine particles and no more than 20% of total volume be large pieces.
 - 1. It is understood that Mulch quality will vary significantly from supplier to supplier and region to region. The above requirements may be modified to conform to the source material from locally reliable suppliers as approved by the Owner's Representative.
- B. Submit suppliers product data that product meets the requirements and two gallon sample for approval.

2.2 WOOD CHIPS:

- A. Wood Chips from an arborist chipping operation with less than 20% by volume green leaves. Chips stockpiled from the tree removal process may be used.

2.3 TREE PROTECTION FENCING:

- A. CHAIN LINK FENCE: 6 feet tall metal chain link fence set in metal frame panels on movable core drilled concrete blocks of sufficient size to hold the fence erect in areas of existing paving to remain.
- B. GATES: For each fence type and in each separate fenced area, provide a minimum of one 3 foot wide gate. Gates shall be lockable. The location of the gates shall be approved by the Owner's Representative.
- C. Submit suppliers product data that product meets the requirements for approval.

2.4 TREE PROTECTION SIGN:

- A. Heavy-duty cardboard signs, 8.5 inches x 11 inches, white colored background with black 2 inch high or larger letters block letters. The signs shall be attached to the tree protection fence every 50 feet o.c. The tree protection sign shall read "Tree and Plant Protection Area- Keep Out".

2.5 TREE GROWTH REGULATOR (TGR)

- A. Cambistat 25C.
- B. Submit suppliers product data that product meets the requirements for approval.

2.6 MATTING

- A. Matting for vehicle and work protection shall be heavy duty matting designed for vehicle loading over tree roots, Altumamats as manufactured by Altumamats, Inc. Franklin, PA 16323 or approved equal.
- B. Submit suppliers product data that product meets the requirements for approval.

2.7 GEOGRID

- A. Geogrid shall be woven polyester fabric with PVC coating, Uni-axial or biaxial geogrid, inert to biological degradation, resistant to naturally occurring chemicals, alkalis, acids.
 - 1. Geogrid shall be Miragrid 2XT as manufactured by Ten Cate Nicolon, Norcross, GA. <http://www.tencate.com> or approved equal.
- B. Submit suppliers product data that product meets the requirements for approval.

2.8 FILTER FABRIC

- A. Filter Fabric shall be nonwoven polypropylene fibers, inert to biological degradation and resistant of naturally occurring chemicals, alkalis and acids.
 - 1. Mirafi 135 N as manufactured by Ten Cate Nicolon, Norcross, GA. <http://www.tencate.com> or approved equal.
- B. Submit suppliers product data that product meets the requirements for approval.

PART 3 – EXECUTION

3.1 SITE EXAMINATION

- A. Examine the site, tree, plant and soil conditions. Notify the Owner's Representative in writing of any conditions that may impact the successful Tree and Plant Protections that is the intent of this section.

3.2 COORDINATION WITH PROJECT WORK

- A. The Contractor shall coordinate with all other work that may impact the completion of the work.
- B. Prior to the start of Work, prepare a detailed schedule of the work for coordination with other trades.
- C. Coordinate the relocation of any irrigation lines currently present on the irrigation plan, heads or the conduits of other utility lines or structures that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

3.3 TREE AND PLANT PROTECTION AREA: The Tree and Plant Protection Area is defined as all areas indicated on the tree protection plan. Where no limit of the Tree and Plant Protection area is defined on the drawings, the limit shall be the drip line (outer edge of the branch crown) of each tree.

3.4 PREPARATION:

- A. Prior to the preconstruction meeting, layout the limits of the Tree and Plant Protection Area and then alignments of required Tree and Plant Protection Fencing and root pruning. Obtain the Owner's Representative's approval of the limits of the protection area and the alignment of all fencing and root pruning.
- B. Flag all trees and shrubs to be removed by wrapping orange plastic ribbon around the trunk and obtain the Owner's Representative's approval of all trees and shrubs to be removed prior to the start of tree and shrub removal. After approval, mark all trees and shrubs to be removed with orange paint in a band completely around the base of the tree or shrub 4.5 feet above the ground.
- C. Flag all trees and shrubs to remain with white plastic ribbon tied completely around the trunk or each tree and on a prominent branch for each shrub. Obtain the Owner's Representative's approval of all trees and shrubs to be remain prior to the start of tree and shrub removal.
- D. Prior to any construction activity at the site including utility work, grading, storage of materials, or installation of temporary construction facilities, install all tree protection fencing, Filter Fabric, silt fence, tree protection signs, Geogrid, Mulch and or Wood Chips as shown on the drawings.

3.5 SOIL MOISTURE

- A. Volumetric soil moisture level, in all soils within the Tree and Plant Protection Area shall be maintained above permanent wilt point to a depth of at least 8 inches. No soil work or other activity shall be permitted within the Tree and Plant Protection Area when the volumetric soil moisture is above field capacity. The permanent wilt point and field capacity for each type of soil texture shall be defined as follows (numbers indicate percentage volumetric soil moisture).

Soil type	Permanent wilt point v/v	Field capacity v/v
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

- 1. Volumetric soil moisture shall be measured with a digital, electric conductivity meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent meter.
- B. The Contractor shall confirm the soil moisture levels with a moisture meter. If the moisture is too high, suspend operations until the soil moisture drains to below field capacity.

3.6 ROOT PRUNING:

- A. Prior to any excavating into the existing soil grade within 25 feet of the limit of the Tree and Plant Protection Area or trees to remain, root prune all existing trees to a depth of 24 inches below existing grade in alignments following the edges of the Tree and Plant Protection Area or as directed by the Owner's Representative. Root pruning shall be in conformance with ANSI A300 (part 8) latest edition.
 - 1. Using a rock saw, chain trencher or similar trenching device, make a vertical cut within 2 feet of the limit of grading.
 - 2. After completion of the cut, make clean cuts with a lopper, saw or pruner to remove all torn root ends on the tree side of the excavation, and backfill the trench immediately with existing soil, filling all voids.

3.7 INSTALLATION OF GEOGRIDS, FILTER FABRIC, MATTING, WOOD CHIPS AND OR MULCH

- A. Install Geogrids, Filter Fabric, matting, Wood Chips and or Mulch in areas and depths shown on the plans and details or as directed by the Owner's representative. In general it is the intent of this specification to provide the following levels of protection:
 - 1. All areas within the Tree and Plant Protection area provide a minimum of 5 inches of Wood Chips or Mulch.
 - 2. Areas where foot traffic or storage of lightweight materials is anticipated to be unavoidable provide a layer of Filter Fabric under the 5 inches of Wood Chips or Mulch.
 - 3. Areas where occasional light vehicle traffic is anticipated to be unavoidable provide a layer of Geogrids under 8 inches of Wood Chips or Mulch.
 - 4. Areas where heavy vehicle traffic is unavoidable provide a layer of Geogrids under 8 - 12 inches of Wood Chips or Mulch and a layer of matting over the Wood Chips or Mulch.
- B. The Owner's Representative shall approve the appropriate level of protection.
- C. In the above requirements, light vehicle is defined as a track skid steer with a ground pressure of 4 psi or lighter. A heavy vehicle is any vehicle with a tire or track pressure of greater than 4 psi. Lightweight materials are any packaged materials that can be physically moved by hand into the location. Bulk materials such as soil, or aggregate shall never be stored within the Tree and Plant Protection Area.

3.8 PROTECTION:

- A. Protect the Tree and Plant Protection Area at all times from compaction of the soil; damage of any kind to trunks, bark, branches, leaves and roots of all plants; and contamination of the soil, bark or leaves with construction materials, debris, silt, fuels, oils, and any chemicals substance. Notify the Owner's Representative of any spills, compaction or damage and take corrective action immediately using methods approved by the Owner's Representative.

3.9 GENERAL REQUIREMENTS AND LIMITATIONS FOR OPERATIONS WITHIN THE TREE AND PLANT PROTECTION AREA:

- A. The Contractor shall not engage in any construction activity within the Tree and Plant Protection Area without the approval of the Owner's Representative including: operating, moving or storing equipment; storing supplies or materials; locating temporary facilities including trailers or portable toilets and shall not permit employees to traverse the area to access adjacent areas of the project or use the area for lunch or any other work breaks. Permitted activity, if any, within the Tree and Plant Protection Area may be indicated on the drawings along with any required remedial activity as listed below.
- B. In the event that construction activity is unavoidable within the Tree and Plant Protection Area, notify the Owner's Representative and submit a detailed written plan of action for approval. The plan shall include: a statement detailing the reason for the activity including why other areas are not suited; a description of the proposed activity; the time period for the activity, and a list of remedial actions that will reduce the impact on the Tree and Plant Protection Area from the activity. Remedial actions shall include but shall not be limited to the following:
 - 1. In general, demolition and excavation within the drip line of trees and shrubs shall proceed with extreme care either by the use of hand tools, directional boring and or Air Knife excavation where indicated or with other low impact equipment that will not cause damage to the tree, roots or soil.
 - 2. When encountered, exposed roots, 1 inches and larger in diameter shall be worked around in a manner

that does not break the outer layer of the root surface (bark). These roots shall be covered in Wood Chips and shall be maintained above permanent wilt point at all times. Roots one inch and larger in diameter shall not be cut without the approval of the owner's representative. Excavation shall be tunneled under these roots without cutting them. In the areas where roots are encountered, work shall be performed and scheduled to close excavations as quickly as possible over exposed roots.

3. Tree branches that interfere with the construction may be tied back or pruned to clear only to the point necessary to complete the work. Other branches shall only be removed when specifically indicated by the Owner's Representative. Tying back or trimming of all branches and the cutting of roots shall be in accordance with accepted arboricultural practices (ANSI A300, part 8) and be performed under supervision of the arborist.
4. Matting: Install temporary matting over the Wood Chips or Mulch to the extent indicated. Do not permit foot traffic, scaffolding or the storage of materials within the Tree and Plant Protection Area to occur off of the temporary matting.
5. Trunk Protection: Protect the trunk of each tree to remain by covering it with a ring of 8 foot long 2 inch x 6 - inch planks loosely banded onto the tree with 3 steel bands. Staple the bands to the planks as necessary to hold them securely in place. Trunk protection must be kept in place no longer than 12 months. If construction requires work near a particular tree to continue longer than 12 months, the steel bands shall be inspected every six months and loosened if they are found to have become tight.
6. Air Excavation Tool: If excavation for footings or utilities is required within the Tree and Plant Protection Area, air excavation tool techniques shall be used where practical or as designed on the drawings.
 - a. Remove the Wood Chips from an area approximately 18 inches beyond the limits of the hole or trench to be excavated. Cover the Wood Chips for a distance of not less than 15 feet around the limit of the excavation area with Filter Fabric or plastic sheeting to protect the Wood Chips from silt. Mound the Wood Chips so that the plastic slopes towards the excavation.
 - b. Using a sprinkler or soaker hose, apply water slowly to the area of the excavation for a period of at least 4 hours, approximately 12 hours prior to the work so that the ground water level is at or near field capacity at the beginning of the work. For excavations that go beyond the damp soil, rewet the soil as necessary to keep soil moisture near field capacity.
 - c. Using an air excavation tool specifically designed and manufactured for the intended purpose, and at pressures recommended by the manufacturer of the equipment, fracture the existing soil to the shape and the depths required. Work at rates and using techniques that do not harm tree roots. Air pressure shall be a maximum of 90-100 psi.
 - 1.) The air excavation tool shall be "Air-Spade" as manufactured by Concept Engineering Group, Inc., Verona, PA (412) 826-8800, or Air Knife as manufactured by Easy Use Air Tools, Inc. Allison Park, Pa (866) 328-5723 or approved equal.
 - d. Using a commercial, high-powered vacuum truck if required, remove the soil from the excavation produced by the Air Knife excavation. The vacuum truck should generally operate simultaneously with the hose operator, such that the soil produced is picked up from the excavation hole, and the exposed roots can be observed and not damaged by the ongoing operation. Do not drive the vacuum truck into the Tree and Plant Protection Area unless the area is protected from compaction as approved in advance by the Owner's Representative.
 - e. Remove all excavated soil and excavated Wood Chips, and contaminated soil at the end of the excavation.
 - f. Schedule the work so that foundations or utility work is completed immediately after the excavation. Do not let the roots dry out. Mist the roots several times during the day. If the excavated area must remain open over night, mist the roots and cover the excavation with black plastic.
 - g. Dispose of all soil in a manner that meets local laws and regulations.
 - h. Restore soil within the trench as soon as the work is completed. Utilize soil of similar texture to the removed soil and lightly compact with hand tools. Leave soil mounded over the trench to a height of approximately 10% of the trench depth to account for settlement.
 - i. Restore any Geogrids, Filter Fabric, Wood Chips or Mulch and or matting that was previously required for the area.

3.10 TREE REMOVAL:

- A. Remove all trees indicated by the drawings and specifications, as requiring removal, in a manner that will not damage adjacent trees or structures or compacts the soil.
- B. Remove trees that are adjacent to trees or structures to remain, in sections, to limit the opportunity of damage to adjacent crowns, trunks, ground plane elements and structures.
- C. Do not drop trees with a single cut unless the tree will fall in an area not included in the Tree and Plant Protection Area. No tree to be removed within 50 feet of the Tree and Plant Protection Area shall be pushed over or up-rooted using a piece of grading equipment.
- D. Protect adjacent paving, soil, trees, shrubs, ground cover plantings and understory plants to remain from damage during all tree removal operations, and from construction operations. Protection shall include the root system, trunk, limbs, and crown from breakage or scarring, and the soil from compaction.
- E. Remove stumps and immediate root plate from existing trees to be removed. Grind trunk bases and large buttress roots to a depth of the largest buttress root or at least 18 inches below the top most roots which ever is less and over the area of three times the diameter of the trunk (DBH).
 - 1. For trees where the stump will fall under new paved areas, grind roots to a total depth of 18 inches below the existing grade. If the sides of the stump hole still have greater than approximately 20% wood visible, continue grinding operation deeper and or wider until the resulting hole has less than 20% wood. Remove all wood chips produced by the grinding operation and back fill in 8 inch layers with controlled fill of a quality acceptable to the site engineer for fill material under structures, compacted to 95% of the maximum dry density standard proctor. The Owner's Representative shall approve each hole at the end of the grinding operation.
 - 2. In areas where the tree location is to be a planting bed or lawn, remove all woodchips and backfill stump holes with planting soil as defined in Specification Section Planting Soil, in maximum of 12 inch layers and compact to 80 - 85% of the maximum dry density standard proctor.

3.11 PRUNING:

- A. Within six months of the estimated date of substantial completion, prune all dead or hazardous branches larger than 2 inch in diameter from all trees to remain.
- B. Implement all pruning recommendations found in the arborist report.
- C. Prune any low, hanging branches and vines from existing trees and shrubs that overhang walks, streets and drives, or parking areas as follows:
 - 1. Walks - within 8 feet vertically of the proposed walk elevation.
 - 2. Parking areas - within 12 feet vertically of the proposed parking surface elevation.
 - 3. Streets and drives - within 14 feet vertically of the proposed driving surface elevation.
- D. All pruning shall be done in accordance with ANSI A300 (part 1), ISA BMP Tree Pruning (latest edition, and the "Structural Pruning: A Guide for the Green Industry", Edward Gilman, Brian Kempf, Nelda Matheny and Jim Clark, 2013 Urban Tree Foundation, Visalia CA.
- E. Perform other pruning task as indicated on the drawings or requested by the Owner's Representative.
- F. Where tree specific disease vectors require, sterilize all pruning tools between the work in individual trees.

3.12 WATERING

- A. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants to be preserved during the entire construction period. Adequate water is defined to be maintaining soil moisture above the permanent wilt point to a depth of 8 inches or greater.
- B. The Contractor shall adjust the automatic irrigation system, if available, and apply additional water, using hoses or water tanks as required.
- C. Periodically test the moisture content in the soil within the root zone to determine the water content.

3.13 WEED REMOVAL

- A. During the construction period, control any plants that seed in and around the fenced Tree and Plant Protection area at least three times a year.
 - 1. All plants that are not shown on the planting plan or on the Tree and Plant Protection Plan to remain shall be considered as weeds.
- B. At the end of the construction period provide one final weeding of the Tree and Plant Protection Area.

3.14 INSECT AND DISEASE CONTROL

- A. Monitor all plants to remain for disease and insect infestations during the entire construction period. Provide all disease and insect control required to keep the plants in a healthy state using the principles of Integrated Plant Management (IPM). All pesticides shall be applied by a certified pesticide applicator.

3.15 CLEAN-UP

- A. During tree and plant protection work, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
 - 1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.
- B. Once tree protection work is complete, wash all soil from pavements and other structures. Ensure that Mulch is confined to planting beds.
- C. Make all repairs to grades, ruts, and damage to the work or other work at the site.
- D. Remove and dispose of all excess Mulch, Wood Chips, packaging, and other material brought to the site by the Contractor.

3.16 REMOVAL OF FENCING AND OTHER TREE AND PLANT PROTECTION

- A. At the end of the construction period or when requested by the Owner's Representative remove all fencing, Wood Chips or Mulch, Geogrids and Filter Fabric, trunk protection and or any other Tree and Plant Protection material.

3.17 DAMAGE OR LOSS TO EXISTING PLANTS TO REMAIN

- A. Any trees or plants designated to remain, and which are damaged by the Contractor shall be replaced in kind by the Contractor at their own expense. Trees shall be replaced with a tree of similar species and of equal size or 6 inch caliper, which ever is less. Shrubs shall be replaced with a plant of similar species and equal size or the largest size plants reasonably available, which ever is less. Where replacement plants are to be less than the size of the plant that is damaged, the Owner's Representative shall approve the size and quality of the replacement plant.
 - 1. All trees and plants shall be installed per the requirements of Specification Section Planting.
- B. Plants that are damaged shall be considered as requiring replacement or appraisal in the event that the damage affects more than 25% of the crown, 25% of the trunk circumference, or root protection area, or the tree is damaged in such a manner that the tree could develop into a potential hazard. Trees and shrubs to be replaced shall be removed by the Contractor at his own expense.
 - 1. The Owner's Representative may engage an independent arborist to assess any tree or plant that appears to have been damaged to determine their health or condition.
- C. Any tree that is determined to be dead, damaged or potentially hazardous by the Owner's arborist and upon the request of the Owner's Representative shall be immediately removed by the Contractor at no additional expense to the owner. Tree removal shall include all clean up of all wood parts and grinding of the stump to a depth sufficient to plant the replacement tree or plant, removal of all chips from the stump site and filling the resulting hole with topsoil.
- D. Any remedial work on damaged existing plants recommended by the consulting arborist shall be completed by the Contractor at no cost to the owner. Remedial work shall include but is not limited to: soil compaction remediation and vertical mulching, pruning and or cabling, insect and disease control including injections,

compensatory watering, additional mulching, and could include application tree growth regulators (TGR).

- E. Remedial work may extend up to two years following the completion of construction to allow for any requirements of multiple applications or the need to undertake applications at required seasons of the year.

END OF SECTION 015639

SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Installation of Storm Water Pollution Prevention Plan (SWPPP) measures as per plans, specifications and the project SWPPP document for the purpose of preventing the discharge of pollutants from the construction site.
- B. Compliance with local, state and federal regulations.

1.2 REFERENCES

- A. California Storm Water Best Management Practice Handbook for Construction Activity (BMP Handbook)
- B. Construction General Permit (CGP) Order No. 2009-009-DWQ as amended by 2010-0014-DWQ and 2012-0006-DWQ.

1.3 SUBMITTAL REQUIREMENTS

- A. Product Data: Provide product catalog cut sheets of all temporary and permanent equipment and specialty items that will be provided to comply with the SWPPP, including items necessary for storage, disposal and recycling.
- B. Shop Drawings: Provide site plan indicating construction staging, storage, refuse areas and vehicular routing and parking areas.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use materials of a class, grade and type needed to meet the performance described in the BMP Handbook and project SWPPP document.

PART 3 - EXECUTION

3.1 QUALIFIED SWPPP DEVELOPER (QSD)

- A. The **Owner or Contractor** shall designate a Qualified SWPPP Developer (QSD) having registrations, certifications and appropriate experience as defined by the State of California Construction General Permit (CGP) Order No. 2009-009-DWQ to perform the following:
1. Prepare, certify and amend as required the project SWPPP document.
 2. Assist the owner in obtaining permit coverage prior to the commencement of construction activity through filing of Permit Registration Document (PRDs) on the Storm Water Multiple Application and Report Tracking System (SMARTS).
 3. Assist the owner in filing the Notice of Termination (NOT) when construction is complete and final stabilization has been reached.

3.2 QUALIFIED SWPPP PRACTITIONER (QSP)

- A. The owner shall designate a Qualified SWPPP Practitioner (QSP) having registrations, certifications and appropriate experience as defined by the State of California Construction General Permit (CGP) Order No. 2009-009-DWQ to perform the following:
1. Conduct storm water and non-storm water visual inspections of Best Management Practices (BMPs) and prepare documentation as prescribed by the CGP according to the risk level and project type.
 2. Identifying BMP failures or shortcomings and provide an action plan to correct the deficiencies.
 3. Conduct discharge monitoring as prescribed by the CGP for pH, turbidity, and non-visible pollutant monitoring, according to the project risk level and project type.
 4. Develop a Rain Event Action Plan (REAP) for Risk Level 2 and 3 projects for qualifying rain events.
 5. Conduct pre-storm event visual inspections for qualifying rain events.
 6. Implement a Construction Site Monitoring Program (CSMP).
 7. Track weather forecasts from the National Oceanic and Atmospheric Administration (NOAA) in accordance with Permit requirements.
 8. Complete applicable monitoring, sampling, and inspection logs, forms and documents for filing to the Storm Water Multiple Application and Report Tracking System (SMARTS).
 9. Report Numeric Action Level (NAL) exceedances to SMARTS for Risk Level 2 and 3 projects.
 10. Provide assistance to the owner with annual reporting requirements.

3.3 PERFORMANCE BY CONTRACTOR

- A. General
1. Keep the original SWPPP document in a readily accessible location at the construction site from the commencement of construction activity until submission of the Notice of Termination (NOT) for storm water discharges associated with construction activity. Contractors with day to day operation control over SWPPP implementation shall have the original SWPPP document available at a central location, on-site, for the use of all operators and those identified as having responsibility under the SWPPP.
 2. Review the SWPPP. Ensure that all key personnel understand the requirements of the SWPPP.

3. Provide to the QSD, names of all key subcontractors involved in earthwork/land disturbing activities.

B. Good Site Management "Housekeeping"

1. For projects designated as Risk Level 1 and above, implement good site management (i.e., "housekeeping") measures for construction materials that could potentially be a threat to water quality if discharged. At a minimum, the contractor shall implement the following good housekeeping measures:
 - a. Conduct an inventory of the products used and/or expected to be used and the end products that are produced and/or expected to be produced. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e. poles, equipment pads, cabinets, conductors, insulators, bricks, etc.).
 - b. Cover and berm loose stockpiled construction materials that are not actively being used (i.e. soil, spoils, aggregate, fly-ash, stucco, hydrated lime, etc.).
 - c. Store chemicals in watertight containers (with appropriate secondary containment to prevent any spillage or leakage) or in a storage shed (completely enclosed).
 - d. Minimize exposure of construction materials to precipitation. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e. poles, equipment pads, cabinets, conductors, insulators, bricks, etc.).
 - e. Implement Best Management Practices to prevent the off-site tracking of loose construction and landscape materials.
2. For projects designated as Risk Level 1 and above, implement good housekeeping measures for waste management, which, at a minimum, shall consist of the following:
 - a. Prevent disposal of any rinse or wash waters or materials on impervious or pervious site surfaces or into the storm drain system.
 - b. Ensure the containment of sanitation facilities (e.g., portable toilets) to prevent discharges of pollutants to the storm water drainage system or receiving water.
 - c. Clean or replace sanitation facilities and inspect them regularly for leaks and spills.
 - d. Cover waste disposal containers at the end of every business day and during a rain event.
 - e. Prevent discharges from waste disposal containers to the storm water drainage system or receiving water.
 - f. Contain and securely protect stockpiled waste material from wind and rain at all times unless actively being used.
 - g. Implement procedures that effectively address hazardous and non-hazardous spills.
 - 1) Equipment and materials for cleanup of spills shall be available on site. Spills and leaks shall be cleaned up immediately and disposed of properly.
 - 2) Appropriate spill response personnel shall be assigned and trained.
 - 3) Ensure the containment of concrete washout areas and other washout areas that may contain additional pollutants so there is no discharge into the underlying soil and onto the surrounding areas.
3. For projects designated as Risk Level 1 and above, implement good housekeeping for vehicle storage and maintenance, which, at a minimum, shall consist of the following:

- a. Prevent oil, grease, or fuel to leak in to the ground, storm drains or surface waters.
 - b. Place all equipment or vehicles, which are to be fueled, maintained and stored in a designated area fitted with appropriate Best Management Practices.
 - c. Clean leaks immediately and dispose of leaked materials properly.
4. For projects designated as Risk Level 1 and above, implement good housekeeping for landscape materials, which, at a minimum, shall consist of the following:
 - a. Contain stockpiled materials such as mulches and topsoil when they are not actively being used.
 - b. Contain all fertilizers and other landscape materials when they are not actively being used.
 - c. Discontinue the application of any erodible landscape material within two days before a forecasted rain event or during periods of precipitation.
 - d. Apply erodible landscape material at quantities and application rates according to manufacture recommendations or based on written specifications by knowledgeable and experienced field personnel.
 - e. Stack erodible landscape material on pallets and cover or store such materials when not being used or applied.
5. Maintain an inventory of materials in association with the Material Safety Data Sheet (MSDS) per OSHA requirements. Provide to QSP upon request.
6. For projects designated as Risk Level 1 and above, implement good housekeeping measures on the construction site to control the air deposition of site materials and from site operations. Such particulates can include, but are not limited to, sediment, nutrients, trash, metals, bacteria, oil and grease and organics.
7. For projects designated as Risk Level 2 or 3, implement the Rain Event Action Plan (REAP) as directed by the QSP.
8. For projects designated as Risk Level 1 and above, begin implementing repairs or changes to BMPs within 72 hours of identification as directed by the QSP and complete the changes as soon as possible.

C. Non-Storm Water Management

1. For projects designated as Risk Level 1 and above, implement measures to control all non-storm water discharges during construction.
2. For projects designated as Risk Level 1 and above, wash vehicles in such a manner as to prevent non-storm water discharges.
3. For projects designated as Risk Level 1 and above, clean streets in such a manner as to prevent unauthorized non-storm water discharges.

D. Erosion Control

1. For projects designated as Risk Level 1 and above, implement effective wind erosion control.
2. For projects designated as Risk Level 1 and above, provide effective soil cover for inactive areas and all finished slopes, open space, utility backfill, and completed lots.
3. For projects designated as Risk Level 1 and above, limit the use of plastic materials when more sustainable, environmentally friendly alternatives exist. Where plastic materials are deemed necessary, the discharger shall consider the use of plastic materials resistant to solar degradation.

E. Sediment Controls

1. For projects designated as Risk Level 1 and above, establish and maintain effective perimeter controls and stabilize all construction entrances and exits to sufficiently control erosion and sediment discharges from the site.
2. For projects designated as Risk Level 1 and above, on sites where sediment basins are to be used, at minimum, install and maintain sediment basins according to the method provided in CASQA's Construction BMP Guidance Handbook.
3. For projects designated as Risk Level 2 or 3, implement appropriate erosion control Best Management Practices (runoff control and soil stabilization) in conjunction with sediment control Best Management Practices for areas under active construction. Active areas of construction are areas undergoing land surface disturbances.
4. For projects designated as Risk Level 2 or 3, install linear sediment controls along the toe of the slope, face of the slope, and at the grade breaks of exposed slopes to comply with sheet flow lengths in accordance with Table 1.

Table 1 – Critical Slope/Sheet Flow Length Combinations

Slope Percentage	Sheet Flow Length Not to Exceed
0 - 25 percent	20 feet
25 - 50 percent	15 feet
Over 50 percent	10 feet

5. For projects designated as Risk Level 2 or 3, ensure that construction activity traffic to and from the project is limited to entrances and exits that employ effective controls to prevent offsite tracking of sediment.
6. For projects designated as Risk Level 2 or 3, ensure that all storm drain inlets and perimeter controls, runoff control Best Management Practices, and pollutant controls at entrances and exits (e.g. tire washoff locations) are maintained and protected from activities that reduce their effectiveness.
7. For projects designated as Risk Level 2 or 3, inspect on a daily basis all immediate access roads daily. At a minimum daily (when necessary) and prior to any rain event, remove any sediment or other construction activity related materials that are deposited on the roads (by vacuuming or sweeping).

F. Run-on and Run-off Controls

1. For projects designated as Risk Level 1 and above, effectively manage all run-on, all runoff within the site and all runoff that discharges off the site. Run-on from offsite shall be directed away from all disturbed areas or shall collectively be in compliance with the effluent limitations in this General Permit.

END OF SECTION 01 57 23

OWNER-FURNISHED PRODUCTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Materials and Equipment.

1.02 SECTION INCLUDES

- A. Requirements for the following:
 - (1) Installing Owner-furnished materials and equipment.
 - (2) Providing necessary utilities, connections and rough-ins.

1.03 DEFINITIONS

- A. Owner: District, who is providing/furnishing materials and equipment.
- B. Installing Contractor: Contractor, who is installing the materials and equipment furnished by the Owner.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Receive, store and handle products in accordance with the manufacturer's instructions.
- B. Protect equipment items as required to prevent damage during storage and construction.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

- A. Installing Contractor's Responsibilities:
 - (1) Verify mounting and utility requirements for Owner-furnished materials and equipment items.
 - (2) Provide mounting and utility rough in for all items where required.
 - (a) Rough in locations, sizes, capacities, and similar type items shall be as indicated and required by product manufacturer.
- B. Owner and Installing Contractor(s) Responsibilities:

- (1) Owner-Furnished/Contractor Installed (“OFCI”): Furnished by the Owner; installed by the Installing Contractor.
 - (a) General: Owner and Installing Contractor(s) will coordinate deliveries of materials and equipment to coincide with the construction schedule.
 - (b) Owner will furnish specified materials and equipment delivered to the site. Owner/vendor’s representative shall be present on Site at the time of delivery to comply with the contract requirements and Specifications Section 01 43 00, Materials and Equipment, Article 1.04.
 - (c) The Owner furnishing specified materials and equipment is responsible to provide manufacturer guarantees as required by the Contract to the Installing Contractor.
 - (d) The Installing Contractor shall:
 - 1) Review, verify and accept the approved manufacturer’s submittal/Shop Drawings for all materials and equipment required to be installed by the Installer Contractor and furnished by the Owner. Any discrepancies, including but not limited to possible space conflicts, should be brought to the attention of the Project Manager and/or Program Manager, if applicable.
 - 2) Coordinate timely delivery. Installing Contractor shall receive materials and equipment at Site when delivered and give written receipt at time of delivery, noting visible defects or omissions; if such declaration is not given, the Installing Contractor shall assume responsibility for such defects and omissions.
 - 3) Store materials and equipment until ready for installation and protect from loss and damage. Installing Contractor is responsible for providing adequate storage space.
 - 4) Coordinate with other bid package contractors and field measurement to ensure complete installation.
 - 5) Uncrate, assemble, and set in place.
 - 6) Provide adequate supports.
 - 7) Install materials and equipment in accordance with manufacturer’s recommendations, instructions, and Shop Drawings, supply labor and material required, and make mechanical, plumbing, and electrical connections required to operate equipment.
 - 8) Be certified by equipment manufacturer for installation of the specific equipment supplied by the Owner.
 - 9) Provide anchorage and/or bracing as required for seismic restraint per Title 24, UBC Standard 27-11 and all other applicable codes.
 - 10) Provide the contract-required warranty and guarantee for all work, materials and equipment, and installation upon its completion and acceptance by the District. Guarantee includes all costs associated with

the removal, shipping to and from the Site, and re-installation of any equipment found to be defective.

C. Compatibility with Space and Service Requirements:

- (1) Equipment items shall be compatible with space limitations indicated and as shown on the Contract Documents and specified in other sections of the Specifications.
- (2) Modifications to equipment items required to conform to space limitations specified for rough in shall not cause additional cost to the District.

D. Manufacturer's printed descriptions, specifications, and instructions shall govern the Work unless specifically indicated or specified otherwise.

2.02 OWNER FURNISHED/CONTRACTOR INSTALLED MATERIALS AND EQUIPMENT

- A. Classroom projectors & projector mounts for Two-story modular buildings
- B. Foundation embeds for two-story modular buildings
- C. All furnished materials and equipment are indicated or scheduled on the Contract Documents.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install equipment items in accordance with the manufacturer's instructions.
- B. Set equipment items securely in place, rigidly or flexibly mounted in accordance with manufacturers' directions.
- C. Make electrical and mechanical connections as indicated and required.
- D. Touch-up and restore damaged or defaced finishes to the Owner's satisfaction.

3.02 CLEANING AND PROTECTION

- A. Repair or replace items not acceptable to the Architect or Owner.
- B. Upon completion of installation, clean equipment items in accordance with manufacturer's recommendations, and protect from damage until final acceptance of the Work by the Owner.

END OF DOCUMENT

SECTION 01 66 00

PRODUCT DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Access, Conditions and Requirements;
- B. Special Conditions.

1.02 PRODUCTS

- A. Products are as defined in the General Conditions.
- B. Contractor shall not use and/or reuse materials and/or equipment removed from existing Premises, except as specifically permitted by the Contract Documents.
- C. Contractor shall provide interchangeable components of the same manufacturer, for similar components.

1.03 TRANSPORTATION AND HANDLING

- A. Contractor shall transport and handle Products in accordance with manufacturer's instructions.
- B. Contractor shall promptly inspect shipments to confirm that Products comply with requirements, quantities are correct, and products are undamaged.
- C. Contractor shall provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.04 STORAGE AND PROTECTION

- A. Contractor shall store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Contractor shall store sensitive products in weather-tight, climate controlled enclosures.
- B. For exterior storage of fabricated Products, Contractor shall place on sloped supports, above ground.
- C. Contractor shall provide off-site storage and protection when Site does not permit on-site storage or protection.
- D. Contractor shall cover products subject to deterioration with impervious sheet covering and provide ventilation to avoid condensation.
- E. Contractor shall store loose granular materials on solid flat surfaces in a well-drained area and prevent mixing with foreign matter.

- F. Contractor shall provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- G. Contractor shall arrange storage of Products to permit access for inspection and periodically inspect to assure Products are undamaged and are maintained under specified conditions.

PART 2 – PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

END OF DOCUMENT

FIELD ENGINEERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Investigation, and Soils Investigation Report;
- B. Special Conditions;
- C. Site-Visit Certification.

1.02 REQUIREMENTS INCLUDED:

- A. Contractor shall provide and pay for field engineering services by a California-registered engineer, required for the project, including, without limitations:
 - (1) Survey work required in execution of the Project.
 - (2) Civil or other professional engineering services specified, or required to execute Contractor's construction methods.

1.03 QUALIFICATIONS OF SURVEYOR OR ENGINEERS:

Contractor shall only use a qualified licensed engineer or registered land surveyor, to whom District makes no objection.

1.04 SURVEY REFERENCE POINTS:

- A. Existing basic horizontal and vertical control points for the Project are those designated on the Drawings.
- B. Contractor shall locate and protect control points prior to starting Site Work and preserve all permanent reference points during construction. In addition Contractor shall:
 - (1) Make no changes or relocation without prior written notice to District and Architect.
 - (2) Report to District and Architect when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 - (3) Require surveyor to replace Project control points based on original survey control that may be lost or destroyed.

1.05 RECORDS:

Contractor shall maintain a complete, accurate log of all control and survey work as it progresses.

1.06 SUBMITTALS:

- A. Contractor shall submit name and address of Surveyor and Professional Engineer to District and Architect prior to its/their work on the Project.
- B. On request of District and Architect, Contractor shall submit documentation to verify accuracy of field engineering work, at no additional cost to the District.
- C. Contractor shall submit a certificate signed by registered engineer or surveyor certifying that elevations and locations of improvements are in conformance or nonconformance with Contract Documents.

PART 2 – PRODUCTS Not Used.

PART 3 - EXECUTION

3.01 COMPLIANCE WITH LAWS:

Contractor is responsible for meeting all applicable codes, OSHA, safety and shoring requirements.

3.02 NONCONFORMING WORK:

Contractor is responsible for any re-surveying required by correction of nonconforming work.

END OF DOCUMENT

CUTTING AND PATCHING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Inspector, Inspections, and Tests, Integration of Work, Nonconforming Work, and Correction of Work, and Uncovering Work;
- B. Special Conditions;
- C. Hazardous Materials Procedures and Requirements;
- D. Hazardous Materials Certification;
- E. Lead-Based Paint Certification;
- F. Imported Materials Certification.

1.02 CUTTING AND PATCHING:

- A. Contractor shall be responsible for all cutting, fitting, and patching, including associated excavation and backfill, required to complete the Work or to:
 - (1) Make several parts fit together properly.
 - (2) Uncover portions of Work to provide for installation of ill-timed Work.
 - (3) Remove and replace defective Work.
 - (4) Remove and replace Work not conforming to requirements of Contract Documents.
 - (5) Remove Samples of installed Work as specified for testing.
 - (6) Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
 - (7) Attaching new materials to existing remodeling areas – including painting (or other finishes) to match existing conditions.
- B. In addition to Contract requirements, upon written instructions from the District, Contractor shall uncover Work to provide for observations of covered Work in accordance with the Contract Documents; remove samples of installed materials for testing as directed by District; and remove Work to provide for alteration of existing Work.
- C. Contractor shall not cut or alter Work, or any part of it, in such a way that endangers or compromises the integrity of the Work, the Project, or work of others.

1.03 SUBMITTALS:

- A. Prior to any cutting or alterations that may affect the structural safety of Project, or work of others, and well in advance of executing such cutting or alterations, Contractor shall submit written notice to District pursuant to the applicable notice provisions of the Contract Documents, requesting consent to proceed with the cutting or alteration, including the following:
 - (1) The work of the District or other trades.
 - (2) Structural value or integrity of any element of Project.
 - (3) Integrity or effectiveness of weather-exposed or weather-resistant elements or systems.
 - (4) Efficiency, operational life, maintenance or safety of operational elements.
 - (5) Visual qualities of sight-exposed elements.
- B. Contractor's Request shall also include:
 - (1) Identification of Project.
 - (2) Description of affected Work.
 - (3) Necessity for cutting, alteration, or excavations.
 - (4) Effects of Work on District, other trades, or structural or weatherproof integrity of Project.
 - (5) Description of proposed Work:
 - (a) Scope of cutting, patching, alteration, or excavation.
 - (b) Trades that will execute Work.
 - (c) Products proposed to be used.
 - (d) Extent of refinishing to be done.
 - (6) Alternates to cutting and patching.
 - (7) Cost proposal, when applicable.
 - (8) The scheduled date the Contractor intends to perform the Work and the duration of time to complete the Work.
 - (9) Written permission of District or other District contractor(s) whose work will be affected.

1.04 QUALITY ASSURANCE:

- A. Contractor shall ensure that cutting, fitting, and patching shall achieve security, strength, weather protection, appearance for aesthetic match, efficiency, operational life, maintenance, safety of operational elements, and the continuity of existing fire ratings.

- B. Contractor shall ensure that cutting, fitting, and patching shall successfully duplicate undisturbed adjacent profiles, materials, textures, finishes, colors, and that materials shall match existing construction. Where there is dispute as to whether duplication is successful or has been achieved to a reasonable degree, the District's decision shall be final.

1.05 PAYMENT FOR COSTS:

- A. Cost caused by ill-timed or defective Work or Work not conforming to Contract Documents, including costs for additional services of the District, its consultants, including but not limited to the Construction Manager, the Architect, the Project Inspector(s), Engineers, and Agents, will be paid by Contractor and/or deducted from the Contract by the District.
- B. District shall only pay for cost of Work if it is part of the original Contract Price or if a change has been made to the contract in compliance with the provisions of the General Conditions. Cost of Work performed upon instructions from the District, other than defective or nonconforming Work, will be paid by District on approval of written Change Order. Contractor shall provide written cost proposals prior to proceeding with cutting and patching.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Contractor shall provide for replacement and restoration of Work removed. Contractor shall comply with the Contract Documents and with the Industry Standard(s), for the type of Work, and the Specification requirements for each specific product involved. If not specified, Contractor shall first recommend a product of a manufacturer or appropriate trade association for approval by the District.
- B. Materials to be cut and patched include those damaged by the performance of the Work.

PART 3 – EXECUTION

3.01 INSPECTION:

- A. Contractor shall inspect existing conditions of the Site and the Work, including elements subject to movement or damage during cutting and patching, excavating and backfilling. After uncovering Work, Contractor shall inspect conditions affecting installation of new products.
- B. Contractor shall report unsatisfactory or questionable conditions in writing to District as indicated in the General Conditions and shall proceed with Work as indicated in the General Conditions by District.

3.02 PREPARATION:

- A. Contractor shall provide shoring, bracing and supports as required to maintain structural integrity for all portions of the Project, including all requirements of the Project.
- B. Contractor shall provide devices and methods to protect other portions of Project from damage.
- C. Contractor shall, provide all necessary protection from weather and extremes of temperature and humidity for the Project, including without limitation, any work that may be exposed by cutting and patching Work. Contractor shall keep excavations free from water.

3.03 ERECTION, INSTALLATION AND APPLICATION:

- A. With respect to performance, Contractor shall:
 - (1) Execute fitting and adjustment of products to provide finished installation to comply with and match specified tolerances and finishes.
 - (2) Execute cutting and demolition by methods that will prevent damage to other Work, and provide proper surfaces to receive installation of repairs and new Work.
 - (3) Execute cutting, demolition excavating, and backfilling by methods that will prevent damage to other Work and damage from settlement.
- B. Contractor shall employ original installer or fabricator to perform cutting and patching for:
 - (1) Weather-exposed surfaces and moisture-resistant elements such as roofing, sheet metal, sealants, waterproofing, and other trades.
 - (2) Sight-exposed finished surfaces.
- C. Contractor shall execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes as shown or specified in the Contract Documents including, without limitation, the Drawings and Specifications.
- D. Contractor shall fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Contractor shall conform to all Code requirements for penetrations or the Drawings and Specifications, whichever calls for a higher quality or more thorough requirement. Contractor shall maintain integrity of both rated and non-rated fire walls, ceilings, floors, etc.
- E. Contractor shall restore Work which has been cut or removed. Contractor shall install new products to provide completed Work in accordance with requirements of the Contract Documents and as required to match surrounding areas and surfaces.
- F. Contractor shall refinish all continuous surfaces to nearest intersection as necessary to match the existing finish to any new finish.

END OF DOCUMENT

ALTERATION PROJECT PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Integration of Work, Purchase of Materials and Equipment, Uncovering of Work and Non-conforming Work and Correction of Work and Trenches;
- B. Special Conditions.

PART 2 - PRODUCTS

2.01 PRODUCTS FOR PATCHING AND EXTENDING WORK:

- A. New Materials: As specified in the Contract Documents including, without limitation, in the Specifications, Contractor shall match existing products, conditions, and work for patching and extending work.
- B. Type and Quality of Existing Products: Contractor shall determine by inspection, by testing products where necessary, by referring to existing conditions and to the Work as a standard.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Contractor shall verify that demolition is complete and that areas are ready for installation of new Work.
- B. By beginning restoration Work, Contractor acknowledges and accepts the existing conditions.

3.02 PREPARATION:

- A. Contractor shall cut, move, or remove items as necessary for access to alterations and renovation Work. Contractor shall replace and restore these at completion.
- B. Contractor shall remove unsuitable material not as salvage unless otherwise indicated in the Contract Documents. Unsuitable material may include, without limitation, rotted wood, corroded metals, and deteriorated masonry and concrete. Contractor shall replace materials as specified for finished Work.
- C. Contractor shall remove debris and abandoned items from all areas of the Site and from concealed spaces.
- D. Contractor shall prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.

- E. Contractor shall close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity. Contractor shall insulate ductwork and piping to prevent condensation in exposed areas. Contractor shall insulate building cavities for thermal and/or acoustical protection, as detailed.

3.03 INSTALLATION:

- A. Contractor shall coordinate Work of all alternations and renovations to expedite completion and to accommodate District occupancy.
- B. Designated Areas and Finishes: Contractor shall complete all installations in all respects, including operational, mechanical work and electrical work.
- C. Contractor shall remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring Products and finishes to original or specified condition.
- D. Contractor shall refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat and square or straight transition to adjacent finishes.
- E. Contractor shall install products as specified in the Contract Documents, including without limitation, the Specifications.

3.04 TRANSITIONS:

- A. Where new Work abuts or aligns with existing, Contractor shall perform a smooth and even transition. Patched Work must match existing adjacent work in texture and appearance.
- B. When finished surfaces are cut so that a smooth transition with new Work is not possible, Contractor shall terminate existing surface along a straight line at a natural line of division and make a recommendation for resolution to the District and the Architect for review and approval.

3.05 ADJUSTMENTS:

- A. Where removal of partitions or walls results in adjacent spaces becoming one, Contractor shall rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- B. Where a change of plane of 1/4 inch or more occurs, Contractor shall submit a recommendation for providing a smooth transition to the District and the Architect for review and approval.
- C. Contractor shall trim and seal existing wood doors and shall trim and paint metal doors as necessary to clear new floor finish and refinish trim as required.
- D. Contractor shall fit Work at penetrations of surfaces.

3.06 REPAIR OF DAMAGED SURFACES:

- A. Contractor shall patch or replace portions of existing surfaces, which are damaged, lifted, discolored, or showing other imperfections, in the area where the Work is performed.
- B. Contractor shall repair substrate prior to patching finish.

3.07 CULTIVATED AREAS AND OTHER SURFACE IMPROVEMENTS:

- A. Cultivated or planted areas and other surface improvements which are damaged by actions of the Contractor shall be restored by Contractor to their original condition or better, where indicated.
- B. Contractor shall protect and replace, if damaged, all existing guard posts, barricades, and fences.
- C. Contractor shall give special attention to avoid damaging or killing trees, bushes and/or shrubs on the Premises and/or identified in the Contract Documents, including without limitation, the Drawings.

3.08 FINISHES:

- A. Contractor shall finish surfaces as specified in the Contract Documents, including without limitations, the provisions of all Divisions of the Specifications.
- B. Contractor shall finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, Contractor shall refinish entire surface to nearest intersections.

3.09 CLEANING:

- A. Contractor shall continually clean the Site and the Premises as indicated in the Contract Documents, including without limitation, the provisions in the General Conditions and the Specifications regarding cleaning.

END OF DOCUMENT

CONTRACT CLOSEOUT AND FINAL CLEANING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Completion of Work;
- B. Special Conditions;
- C. Temporary Facilities and Controls.

1.02 CLOSEOUT PROCEDURES

Contractor shall comply with all closeout provisions as indicated in the General Conditions.

1.03 FINAL CLEANING

- A. Contractor shall execute final cleaning prior to final inspection.
- B. Contractor shall clean interior and exterior glass and all surfaces exposed to view; remove temporary labels, tape, stains, and foreign substances, polish transparent and glossy surfaces, wax and polish new vinyl floor surfaces, vacuum carpeted and soft surfaces.
- C. Contractor shall clean equipment and fixtures to a sanitary condition.
- D. Contractor shall replace filters of operating equipment.
- E. Contractor shall clean debris from roofs, gutters, down spouts, and drainage systems.
- F. Contractor shall clean Site, sweep paved areas, and rake clean landscaped surfaces.
- G. Contractor shall remove waste and surplus materials, rubbish, and construction facilities from the Site and surrounding areas.

1.04 ADJUSTING

Contractor shall adjust operating products and equipment to ensure smooth and unhindered operation.

1.05 RECORD DOCUMENTS AND SHOP DRAWINGS

- A. Contractor shall legibly mark each item to record actual construction, including:
 - (1) Measured depths of foundation in relation to finish floor datum.
 - (2) Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permit surface improvements.

- (3) Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - (4) Field changes of dimension and detail.
 - (5) Details not on original Contract Drawings
 - (6) Changes made by modification(s).
 - (7) References to related Shop Drawings and modifications.
- B. Contractor will provide one set of Record Drawings to District.
 - C. Contractor shall submit all required documents to District and/or Architect prior to or with its final Application for Payment.

1.06 INSTRUCTION OF DISTRICT PERSONNEL

- A. Before final inspection, at agreed upon times, Contractor shall instruct District's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. For equipment requiring seasonal operation, Contractor shall perform instructions for other seasons within six months or by the change of season.
- C. Contractor shall use operation and maintenance manuals as basis for instruction. Contractor shall review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. Contractor shall prepare and insert additional data in Operation and Maintenance Manual when the need for such data becomes apparent during instruction.
- E. Contractor shall review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Contractor shall provide products, spare parts, maintenance, and extra materials in quantities specified in the Specifications and in Manufacturer's recommendations.
- B. Contractor shall provide District with all required Operation and Maintenance Data at one time. Partial or piecemeal submissions of Operation and Maintenance Data will not be accepted.

PART 2 – PRODUCTS Not Used.

PART 3 – EXECUTION Not Used.

END OF DOCUMENT

OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Completion of the Work;
- B. Special Conditions.

1.02 QUALITY ASSURANCE:

Contractor shall prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.03 FORMAT:

- A. Contractor shall prepare data in the form of an instructional manual entitled "OPERATIONS AND MAINTENANCE MANUAL & INSTRUCTIONS" ("Manual").
- B. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size. When multiple binders are used, Contractor shall correlate data into related consistent groupings.
- C. Cover: Contractor shall identify each binder with typed or printed title "OPERATION AND MAINTENANCE MANUAL & INSTRUCTIONS"; and shall list title of Project and identify subject matter of contents.
- D. Contractor shall arrange content by systems process flow under section numbers and sequence of Table of Contents of the Contract Documents.
- E. Contractor shall provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: The content shall include Manufacturer's printed data, or typewritten data on 24 pound paper.
- G. Drawings: Contractor shall provide with reinforced punched binder tab and shall bind in with text; folding larger drawings to size of text pages.

1.04 CONTENTS, EACH VOLUME:

- A. Table of Contents: Contractor shall provide title of Project; names, addresses, and telephone numbers of the Architect, any engineers, subconsultants, Subcontractor(s), and Contractor with name of responsible parties; and schedule of products and systems, indexed to content of the volume.
- B. For Each Product or System: Contractor shall list names, addresses, and telephone numbers of Subcontractor(s) and suppliers, including local source of supplies and replacement parts.

- C. Product Data: Contractor shall mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: Contractor shall supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Contractor shall not use Project Record Documents as maintenance drawings.
- E. Text: Contractor shall include any and all information as required to supplement product data. Contractor shall provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- F. Warranties and Bonds: Contractor shall bind in one copy of each.

1.05 MANUAL FOR MATERIALS AND FINISHES:

- A. Building Products, Applied Materials, and Finishes: Contractor shall include product data, with catalog number, size, composition, and color and texture designations. Contractor shall provide information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Contractor shall include Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Contractor shall include product data listing applicable reference standards, chemical composition, and details of installation. Contractor shall provide recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: Contractor shall include all additional requirements as specified in the Specifications.
- E. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS:

- A. Each Item of Equipment and Each System: Contractor shall include description of unit or system, and component parts and identify function, normal operating characteristics, and limiting conditions. Contractor shall include performance curves, with engineering data and tests, and complete nomenclature, and commercial number of replaceable parts.
- B. Panelboard Circuit Directories: Contractor shall provide electrical service characteristics, controls, and communications.
- C. Contractor shall include color coded wiring diagrams as installed.
- D. Operating Procedures: Contractor shall include start-up, break-in, and routine normal operating instructions and sequences. Contractor shall include regulation, control, stopping, shut-down, and emergency instructions. Contractor shall include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Contractor shall include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Contractor shall provide servicing and lubrication schedule, and list of lubricants required.

- G. Contractor shall include manufacturer's printed operation and maintenance instructions.
- H. Contractor shall include sequence of operation by controls manufacturer.
- I. Contractor shall provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Contractor shall provide control diagrams by controls manufacturer as installed.
- K. Contractor shall provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- L. Contractor shall provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Contractor shall provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Additional Requirements: Contractor shall include all additional requirements as specified in Specification(s).
- O. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.07 SUBMITTAL:

- A. Contractor shall submit to the District for review two (2) copies of preliminary draft or proposed formats and outlines of the contents of the Manual within thirty (30) days of Contractor's start of Work.
- B. For equipment, or component parts of equipment put into service during construction and to be operated by District, Contractor shall submit draft content for that portion of the Manual within ten (10) days after acceptance of that equipment or component.
- C. Contractor shall submit two (2) copies of a complete Manual in final form prior to final Application for Payment. Copy will be returned with Architect/Engineer comments. Contractor must revise the content of the Manual as required by District prior to District's approval of Contractor's final Application for Payment.
- D. Contractor must submit two (2) copies of revised Manual in final form within ten (10) days after final inspection.

PART 2 – PRODUCTS Not Used.

PART 3 – EXECUTION Not Used.

END OF DOCUMENT

WARRANTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Warranty/Guarantee Information;
- B. Special Conditions.

1.02 FORMAT

- A. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size.
- B. Cover: Contractor shall identify each binder with typed or printed title "WARRANTIES" and shall list title of Project.
- C. Table of Contents: Contractor shall provide title of Project; name, address, and telephone number of Contractor and equipment supplier; and name of responsible principal. Contractor shall identify each item with the number and title of the specific Specification, document, provision, or section in which the name of the product or work item is specified.
- D. Contractor shall separate each warranty with index tab sheets keyed to the Table of Contents listing, providing full information and using separate typed sheets as necessary. Contractor shall list each applicable and/or responsible Subcontractor(s), supplier(s), and/or manufacturer(s), with name, address, and telephone number of each responsible principal(s).

1.03 PREPARATION:

- A. Contractor shall obtain warranties, executed in duplicate by each applicable and/or responsible subcontractor(s), supplier(s), and manufacturer(s), within ten (10) days after completion of the applicable item or work. Except for items put into use with District's permission, Contractor shall leave date of beginning of time of warranty blank until the date of completion is determined.
- B. Contractor shall verify that documents are in proper form, contain full information, and are notarized, when required.
- C. Contractor shall co-execute submittals when required.
- D. Contractor shall retain warranties until time specified for submittal.

1.04 TIME OF SUBMITTALS:

- A. For equipment or component parts of equipment put into service during construction with District's permission, Contractor shall submit a draft warranty for that equipment or component within ten (10) days after acceptance of that equipment or component.

- B. Contractor shall submit for District approval all warranties and related documents within ten (10) days after date of completion. Contractor must revise the warranties as required by the District prior to District's approval of Contractor's final Application for Payment.
- C. For items of work delayed beyond date of completion, Contractor shall provide an updated submittal within ten (10) days after acceptance, listing the date of acceptance as start of warranty period.

PART 2 - PRODUCTS Not Used.

PART 3 – EXECUTION Not Used.

END OF DOCUMENT

RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND PROVISIONS:

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Documents on Work;
- B. Special Conditions.

PART 2 - RECORD DRAWINGS

2.01 GENERAL:

- A. As indicated in the Contract Documents, the District will provide Contractor with one set of reproducible, full size original Contract Drawings (mylars).
- B. Contractor shall maintain at each Project Site one set of marked-up plans and shall transfer all changes and information to those marked-up plans, as often as required in the Contract Documents, but in no case less than once each month. Contractor shall submit to the Project Inspector one set of reproducible vellums of the Project Record Drawings ("As-Built") showing all changes incorporated into the Work since the preceding monthly submittal. The As-Built shall be available at the Project Site. The Contractor shall submit reproducible vellums at the conclusion of the Project following review of the blue-line prints.
- C. Label and date each Record Drawing "RECORD DOCUMENT" in legibly printed letters.
- D. All deviations in construction, including but not limited to pipe and conduit locations and deviations caused by without limitation Change Orders, Construction Claim Directives, RFI's, and Addenda, shall be accurately and legibly recorded by Contractor.
- E. Locations and changes shall be done by Contractor in a neat and legible manner and, where applicable, indicated by drawing a "cloud" around the changed or additional information.

2.02 RECORD DRAWING INFORMATION:

- A. Contractor shall record the following information:
 - (1) Locations of Work buried under or outside each building, including, without limitation, all utilities, plumbing and electrical lines, and conduits.
 - (2) Actual numbering of each electrical circuit to match panel schedule.
 - (3) Locations of significant Work concealed inside each building whose general locations are changed from those shown on the Contract Drawings.
 - (4) Locations of all items, not necessarily concealed, which vary from the Contract Documents.

- (5) Installed location of all cathodic protection anodes.
- (6) Deviations from the sizes, locations, and other features of installations shown in the Contract Documents.
- (7) Locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stubouts, invert elevations, etc.
- (8) Sufficient information to locate Work concealed in each building with reasonable ease and accuracy.

In some instances, this information may be recorded by dimension. In other instances, it may be recorded in relation to the spaces in the building near which it was installed.

- B. Contractor shall provide additional drawings as necessary for clarification.
- C. Contractor shall provide reproducible record drawings, made from final Shop Drawings marked "No Exceptions Taken" or "Approved as Noted."
- D. After review and approval of the marked-up specifications by the Project Inspector, Contractor shall provide electronic copies of the drawings (in PDF format) with one file with all of the sheets and one set of individual sheet files at the conclusion of the Project.

PART 3 - RECORD SPECIFICATIONS

3.01 GENERAL:

- A. Contractor shall mark each section legibly to record manufacturer, trade name, catalog number, and supplier of each Product and item of equipment actually installed.
- B. After review and approval of the marked-up specifications by the Project Inspector, Contractor shall provide one electronic copy of the specifications (in PDF format) at the conclusion of the Project.

PART 4 - MAINTENANCE OF RECORD DOCUMENTS

4.01 GENERAL

- A. Contractor shall store Record Documents apart from documents used for construction as follows:
 - (1) Provide files and racks for storage of Record Documents.
 - (2) Maintain Record Documents in a clean, dry, legible condition and in good order.
- B. Contractor shall not use Record Documents for construction purposes.

PART 5 – PRODUCTS Not Used.

END OF DOCUMENT

SECTION 03 1000

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
 - 1. Formwork for cast-in-place concrete site structures as indicated. This section does not apply to building foundations.
 - 2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.
- C. Related Sections:
 - 1. Section 01 4523: Testing and Inspection.
 - 2. Section 03 2000: Concrete Reinforcement.
 - 3. Section 03 3000: Cast-In-Place Concrete.

1.2 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.

1.3 SUBMITTALS

- A. Submit detailed structural calculations and drawings approved and signed by a California registered Civil Engineer where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or where provision for vehicular traffic through falsework 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. Review and approval will not include form strength and adequacy.
 - C. Product Data: Submit manufacturer's Product Data for form materials and accessories.
 - D. Record Document: Keep an accurate record of the dates of removal of forms, form shores and reshores, and furnish copies to the Architect.
- 1.4 1.04 REGULATORY REQUIREMENTS
- A. California Building Code (CBC), Chapter 19A, and ACI 318-19.
 - B. California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 4, Construction Safety Orders, Article 6, Excavations, Sections 1713 and 1717.
- 1.5 1.05 DELIVERY, STORAGE AND HANDLING
- A. Storage shall prevent damage and permit access to materials for inspection and identification.
 - B. Deliver materials for forms in timely manner to ensure uninterrupted progress.
- 1.6 QUALITY ASSURANCE
- A. Construction of Forms shall comply with the following as a minimum requirement:
 - 1. ACI 347, "Recommended Practice for Concrete Formwork"
 - 2. ACI 318 Section 26.11 and CBC Section 1905A.
 - 3. Tolerances shall conform to those as specified in ACI 301, "Specifications for Structural Concrete for Buildings", as applicable, unless exceeded by requirements of DSA or otherwise indicated or specified.
 - 4. Plywood: Conform to tables for form design and strength in APA Form V 345.
 - B. Prior to construction of formwork for concrete beams and slabs above grade, Contractor shall conduct a meeting at the site to determine and define all camber, which may be required for the project. The Architect, Structural Engineer of record, Contractor and Contractor's formwork installer shall be in attendance at this meeting.
 - C. Mock-ups: Provide mock-ups for all exposed finishes; 100 square feet minimum size. Locate as required by the Architect, for review and approval prior to installation.

PART 2 PRODUCTS

2.1 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. Tube Forms: Sonoco "Seamless Sonotubes," or equal, of the type leaving no marks in concrete, one-piece lengths for required heights.
- F. Joist Forms: Code recognized steel or molded plastic types as required.
- G. 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.
- H. 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.
 - 4. Plywood: "Finland Form," or "Combi Form" distributed by North American Plywood Corporation. The material shall be furnished with hard smooth birch face veneers with phenolic resin thermally fused onto panel sides. Edges shall be factory sealed.
- I. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, not leaving metal within 1-1/2 inch of concrete surface.
- J. 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 ,or "Cast-Off" by Sonneborn/BASF Building Systems. Where form liners are furnished, provide form coatings recommended by form liner manufacturer.
- K. Form Liner: Rigid or resilient type by L.M. Scofield, Symons, or Greenstreak, types shown or directed, matching approved Sample.
- L. Void Forms: Manufactured by SureVoid Products, Inc., 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

3.1 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 with no sagging, displacement, or bulging between studs. Forms and their supports shall be designed so that previously placed structures will not be damaged. Use clean, sound, approved form material, coated with specified materials only, not oil. Provide backing on all plywood joints. Forms shall be true to line within tolerances as permitted under section 1.6 above.

3.2 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.
- B. Finish Lines: Position formwork to maintain hardened concrete finish lines within following permissible deviations.
1. Variation from Plumb:
 - a. In 10'-0" 1/4 inch
 - b. In any story or 20'-0" 3/8 inch
 - c. In 40'-0" or more 3/4 inch
 2. Variation from Level or Grades Indicated:
 - a. In 10'-0" 1/4 inch
 - b. In any bay or 20'-0" maximum 3/8 inch

- c. In 40'-0" or more 3/4 inch
- 3. Cross-Sectional Dimensions:
 - a. Minus 1/4 inch
 - b. Plus 1/2 inch
- C. Building Lines: Variation of linear building lines from established position in plan and related position of columns, walls and partitions:
 - a. In any bay or 10'-0" maximum 1/2 inch
 - b. In 40'-0" or more 1 inch
- D. Slab Openings: Variations in size and location of sleeves and slab openings shall not exceed 1/4 inch.

3.3 ERECTION

- A. Conform to ACI 301 and ACI 347 except as exceeded by the requirements of code, regulatory agencies, or herein.
- B. 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.
- C. Construction: Coat forms with the specified resin coating, not form oil. Construct forms to exact shapes, sizes, lines, and dimensions required to obtain level, plumb, and straight surfaces. Provide openings, offsets, keys, reglets, anchorages, recesses, moldings, chamfers, blocking, screeds, drips, bulkheads, and all other required features. Make forms easily removable without hammering or prying against concrete. Space forms apart with metal spreaders. Construct forms to accurate alignment, location and grades, and provide against sagging, leakage of concrete mortar, or displacement occurring during and after placing of concrete. Coordinate installation of inserts and anchors in forms according to Shop Drawings and requirements for work of other sections.
- D. Camber: Place suitable jacks, wedges, or similar means to induce camber and to correct settlement in forms before and during concrete placing. Camber shall be as determined in pre-installation meeting specified above. In general, formwork shall be capable of accommodating camber of 1/8" per 10' of span plus 1/4". Provide Camber as noted on the Structural Drawings (if required).
- E. 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.
- F. Chamfers: Provide 3/4 inch by 3/4 inch chamfer strips for all exposed concrete corners and edges unless otherwise indicated.

- G. Reglets and Rebates: As specified in Section 03 3000: Cast-In-Place Concrete. Form required reglets and rebates to receive frames, flashing, and other equipment.
- H. Form Joints: Fill joints to produce smooth surfaces, intersections, and arises. Use polymer foam or equivalent fillers at joints and where forms abut or overlap existing concrete to prevent leakage of mortar.
- I. Recesses, Drips, and Profiles: Provide smooth milled wood or pre-formed rubber or plastic shapes of types shown and required.
- J. Re-Use: Clean and recondition form material before re-use.

3.4 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 5 days, floor slabs in less than 7 days, beams and girders in less than 15 days, pan forms for joists may be removed after 3 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 7 days. Shoring shall not be removed until member has acquired sufficient strength to support its weight, load upon it, and added load of construction. In no case shall forms be removed sooner than specified in ACI 347, paragraph 3.6.2.3, or ACI 318 Section 26.11.
- 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.
- C. Reshore structural members as specified per ACI 347R-94. Maintain a form and shoring removal record. Contractor shall submit shoring/reshoring plans and calculations stamped and signed by a licensed civil or structural engineer for review and approval. Reshoring loads to lower floors shall be consistent with the design loads specified on the construction documents and with the acquired strength of the lower floors based on the time they have been allowed to cure before being loaded.
- D. Remove formwork progressively so unbalanced loads are not imposed on the structure.
- E. Avoid damage to concrete surfaces during form removal.
- F. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.
- G. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.

3.5 SURVEY AND ADJUSTMENT:

- A. Check forms before and during placement of concrete, using an instrument, and make corrections as work proceeds.

3.6 EMBEDDED PIPING AND ROUGH HARDWARE:

- A. Comply with ACI 318, Section 26.8. Where work of other sections require openings for passage of pipes, conduits, ducts, and other inserts in the concrete, obtain all dimensions and other information. All necessary pipe sleeves, anchors, or other

required inserts shall be accurately installed as part of the work of other sections, according to following requirements.

B. Conduits or Pipes

1. No pipe/conduit runs shall be embedded in structural concrete unless indicated on the structural drawings.
2. Where pipe/conduit is indicated, it shall conform to the following requirements:
 - a. Conduits/pipes of aluminum shall not be embedded in structural concrete unless coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and reinforcing steel.
 - b. Conduits/pipes shall be located so as not to reduce strength of concrete. In no case place conduit/pipes in a slab 8" thick or less. Conduit buried in a concrete slab shall not have an outside diameter greater than 1/3 the slab thickness nor be placed below the bottom reinforcing steel or over top reinforcing steel. Embedded conduit/pipes shall be approved by the engineer of record prior to concrete placement.

- C. Sleeves: Pipe sleeves may pass through slabs or walls if not exposed to rusting or other deterioration and are of uncoated or galvanized iron or steel. Provide sleeves of diameter large enough to pass any hub or coupling on pipe, including any insulation.

3.7 FIELD QUALITY CONTROL

- A. Inspection: Obtain inspection and approval of forms before placing structural concrete.

3.8 PROTECTION

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

3.9 CLEAN UP

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

END OF SECTION

SECTION 03 2000

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
 - 1. Reinforcing bars for cast-in-place concrete
 - 2. Reinforcing mesh for cast-in-place concrete
 - 3. Accessories, including but not limited to chairs and tie wires
 - 4. Reinforcing bars for masonry
 - 5. Reinforcing bars for site-cast pre-cast concrete
 - 6. Miscellaneous concrete work, including but not limited to areaways, cast-in-place valve boxes, pits, splash blocks, equipment bases, and other items as shown or required to complete all work.
- C. Related Sections:
 - 1. Section 01 4523: Testing and Inspection.
 - 2. Section 03 1000: Concrete Formwork.
 - 3. Section 03 3000: Cast-In-Place Concrete.

1.2 SYSTEM DESCRIPTION

- A. Regulatory Requirements: Fabrication and placement of reinforcing shall be in accordance with requirements of CBC, Chapter 19A and ACI 318-19.

1.3 REFERENCES:

- A. Comply with the following as a minimum requirement:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - b. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 - c. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - d. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

- e. ASTM A497 - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - f. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - g. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- 2. American Concrete Institute (ACI) Publication:
 - a. ACI 315 – Manual of Standard Practice for Detailing Reinforced Concrete Structures.
 - b. ACI 318 – Building Code Requirements for Structural Concrete, as modified by CBC Sections 1905A.
 - 3. American Welding Society (AWS):
 - a. AWS D1.4 – Structural Welding Code – Reinforcing Steel.
 - 4. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.
 - 5. California Building Code, Chapter 19A, Concrete.

1.4 SUBMITTALS

- A. Shop Drawings: Submit steel reinforcement Shop Drawings in accordance with ACI 315. Shop drawings should include complete layouts, sections, and details for congested conditions, typical bending diagrams and offsets, splice lengths and locations, proposed layout where vertical and horizontal bars intersect, and wherever welding is proposed, detailed to conform to AWS and CBC requirements. Include slab plans, size and lengths of reinforcing steel.
- B. Contractor to prepare 3' x 3' sample mock-up on site for review and approval by Owner's Representative prior to installation. Sample will show all concrete finishes, joints and colors.
- C. Certification: Submit copies of welding operator's certificate.
- D. Chemical Analysis: Provide for bars to be welded, in accordance with ACI 318 Section 26.6.4.
- E. Closeout Submittals: Record exact locations of reinforcing that vary from Shop Drawings.

1.5 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, CBC Chapters 17A and 19A, and ACI 318 Chapter 26 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.
 3. Testing to be per CBC Sections 1910A and 1704A.
- C. Certification of Welders: Shop and Project site welding shall be performed by welding operators certified by AWS.

1.6 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. Use metal tags indicating size, length and other marking shown on placement drawings. Maintain tags after bundles are broken.

PART 2 - PRODUCTS

2.1 GENERAL

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

2.2 MATERIALS

- A. Steel Reinforcing Bars: ASTM A615, or ASTM A706 deformed grade 60 billet steel unless otherwise specified or indicated. Deformations to be per ASTM A-305.
- B. Reinforcing Bars for welding: ASTM A706, Grade 60.
- C. Welded Wire Fabric for Reinforcement: ASTM A185, 60 KSI minimum tensile strength.
- 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 CRSI and ACI 315 fabricated from steel wire of required types and sizes. For reinforcement supported from grade, provide properly sized dense precast blocks of concrete with embedded wire ties.
- F. Welding electrodes: AWS D1.4, Table 5.1 and 5.3 low hydrogen electrodes, E9018 for Grade 60 steel.

2.3 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

3.1 INSTALLATION

- A. Bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as indicated on reviewed Shop Drawings. Before installation, and again before concrete is placed, clean reinforcing of loose scale, rust, oil, dirt and any coating that could reduce bond.
- B. Securing in Place: Accurately place bars and wire tie in precise position where bars cross. Bend ends of wire ties away from the forms. Wire tie bars to corners of ties and stirrups. Support bars according to the current edition of "Recommended Practice for Placing Bar Supports" of Concrete Reinforcing Steel Institute, using approved accessories and chairs. Place precast concrete cubes with embedded wire ties to support reinforcing steel bars in concrete placed on grade and in footings. Use care not to damage vapor barriers where they occur. Accurately position, install, and secure reinforcing to prevent displacement during the placement of concrete.
- C. Exposed Concrete Surfaces: Provide stainless steel or exterior quality vinyl plastic tipped chairs, bolsters, and accessories where exposed on exterior or interior concrete surfaces not to be painted or permanently covered. 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.

- D. Clearances: Maintain minimum clear distances between reinforcing bars and face of concrete as indicated on Structural Drawings.
- E. Splices: Do not splice reinforcing bars at the points of maximum stress except where indicated. Lap splices as shown or required to develop the full strength or stress of bars. Stagger splices in horizontal wall bars at least 48" longitudinally in alternate bars and opposite faces.
- F. Field Welding of Bars: As specified on plans for fabrication. All welding to be per ACI 318 Section 26.6.4.
- G. Maintaining Bars In Position: Take adequate precautions to assure that reinforcing position and spacing is maintained during placement of concrete.
- H. Reinforcing Mesh: Lap one full mesh plus 2", or 9" whichever is greater, at splices, wire tie, and support the same as specified for bars.
- I. 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.
- J. Use deformed bars unless otherwise indicated.
- K. Splice Devices:
 - 1. Type and manufacturer as noted on drawings. If substitution is requested, contractor to supply manufacturer calculations and supporting data showing proposed substitution conforms to requirements indicated and supplied.
 - 2. Install in accordance with manufacturer's written instructions.
 - 3. Splices shall develop at least 125% of the yielding strength of the bar.

3.2 FIELD QUALITY CONTROL:

- A. Supervision: Perform Work to this Section under supervision of a capable superintendent.
- B. Inspection: Obtain inspection per CBC Sections 1704A.4.2 & 1903A and approval of reinforcing before concrete is placed.
- C. Welding Inspection: Whether welding is done in the shop or at the site, perform welding of reinforcing bars under inspection of the Testing Laboratory Welding Inspector who is specially qualified and approved by DSA in accordance with CBC Section 1704A.4.2. The welding inspector shall make a systematic record of all welds.
 - 1. This record shall include:
 - a. Identification marks of welders.
 - b. List of defective welds.

c. Manner of correction of defects.

2. The welding inspector shall check the material, equipment details of construction, and procedures as well as the welds. The inspector shall also check the ability of the welder. The welder shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding which is required to be inspected is proper and has been done in conformity with the approved plans and specifications. The welding inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics or any other aid to visual inspection, which the inspector may deem necessary to assure the adequacy of the welding.

3.3 CLEAN UP

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

3.4 PROTECTION

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

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
 - 1. Cast-in-place normal weight and lightweight concrete, placement and finishing for concrete site structures only. Section is not applicable to building foundations or concrete pavement.
- C. Related Sections:
 - 1. Section 01 4523: Testing and Inspection
 - 2. Section 03 1000: Concrete Forms and Accessories.
 - 3. Section 03 2000: Concrete Reinforcement.

1.2 REFERENCES

- A. Comply with the following American Concrete Institute (ACI) Publications as a minimum requirement:
 - 1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 211 – Recommended Practice for Selecting Proportions of Concrete.
 - 3. ACI 301 – Specifications for Structural Concrete.
 - 4. ACI 302.1R – Guide for Concrete Floor and Slab Construction.
 - 5. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
 - 6. ACI 305.1 - Specification for Hot Weather Concreting.
 - 7. ACI 306.1 – Standard Specification for Cold Weather Concreting.
 - 8. ACI 308 – Recommended Practice for Curing Concrete
 - 9. ACI 309 – Recommended Practice for Consolidation of Concrete
 - 10. ACI 318 - Building Code Requirements for Structural Concrete, as modified by CBC Section 1905A.

- B. Comply with the following American Society for Testing and Materials (ASTM) Standards as a minimum requirement:
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 C227 – Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
 13. ASTM C231 – Air Content of Freshly Mixed Concrete by the Pressure Method.
 14. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
 15. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
 16. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 17. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
 18. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
 19. ASTM C567 - Standard Test Method for Determining Density of Structural Lightweight Concrete.

20. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
21. ASTM C845 - Standard Specification for Expansive Hydraulic Cement
22. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
23. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
24. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
25. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures
26. ASTM C1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
27. ASTM D1751 - Standard Test Method for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
28. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
29. ASTM E1155 - Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.
30. 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.
31. ASTM E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings indicating locations of cast-in-place concrete work, dimensioned locations and types of construction and expansion joints, 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 2.2.
 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 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. Limit water content per cubic yard of mixed concrete to: 300 pounds maximum for normal weight concrete, 325 pounds maximum for light weight concrete.
 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: Contractor to provide 3' x 3' mock-up samples for each type of concrete color, finish and jointing for Owner's approval prior to installation.
- D. Certificates: Submit notarized 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, see CBC Section 1903A.5.
 5. Curing materials: ASTM C171.
 6. Manufacturer of ready-mixed concrete shall deliver to the IOR a certificate with each mixer truck. Certificate shall bear the signature of representative of the testing laboratory, and shall state quantity of cement, water, fine and coarse aggregate and admixtures.
 7. Admixtures: ASTM C260.
- E. Admixtures: Submit product data for proposed concrete admixtures.

1.4 QUALITY ASSURANCE

- A. Concrete Manufacturer: Furnish concrete from licensed commercial ready-mix concrete plant conforming to DSA approved plans as well as CBC Chapter 19A and ACI 318 as modified by CBC section 1905A.
- B. 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.

- C. 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.
- D. Contractor shall assist the testing laboratory in obtaining and handling samples at the project site and at the source of materials.
- E. Continuous batch plant inspection requirement may be waived in accordance with CBC Section 1705A.3.3. 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 each day for each approved mix design 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 IOR by a truck driver with load identified thereon. The IOR 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.
- F. Special Inspections and Tests shall be in accordance with CBC Chapter 17A, CBC Section 1910A and Specification Section 01 4523.
- G. Allowable Tolerances: Construct concrete conforming to the tolerances specified in ACI 117 "Recommended Tolerances for Concrete Construction and Materials", as applicable, unless exceeded by requirements of regulatory agencies or otherwise indicated or specified.
- H. Source Quality Control: Refer to the following paragraphs for specific procedures. Concrete materials which, by previous tests or actual service, have shown conformance may be used without testing when so approved by the Architect and DSA. Testing Laboratory shall perform following conformance testing.
 - 1. Portland Cement: Furnish mill certificates in accordance with the CBC section 1910A.1 and acceptable to Architect and DSA, showing conformance with requirements specified.
 - 2. Cementitious Material Test. The concrete supplier shall furnish to the enforcement agency certification from the cement manufacturer that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C 150 for Portland cement and ASTM C 595 or ASTM C 1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification from the manufacturer that they have been manufactured

and tested in compliance with ASTM C 618 or ASTM C 989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's certificate of compliance that represents the materials used by date of shipment for concrete. Cementitious materials without certification of compliance shall not be used per section 1910A.1 of the CBC.

3. Aggregates for Normal Weight Concrete: Test the aggregate before and after concrete mix is designed and whenever character of aggregate varies or source of material is changed in accordance with ASTM C33 and CBC section 1903A.5. Include a sieve analysis. Obtain samples of aggregates at the dry batching or ready-mix concrete plant in accordance with ASTM D75 and perform tests for the properties listed in the following table.
4. Aggregates for Lightweight Concrete: Test the lightweight aggregates before mix is designed and whenever the character of aggregate varies or source is changed in accordance ASTM C330. Include sieve analyses, report on unit weights, report on deleterious substances, unburned or under-burned lumps, loss on ignition, soundness, staining materials, and crushed particles in coarse aggregate. Splitting tensile strength (FSP); 5.5 minimum.

PHYSICAL PROPERTIES		
Physical Properties, units	Test Method	Minimum values
Sieve analysis	ASTM C136	
Organic impurities	ASTM C40	Fine aggregate not darker than reference standard color
Soundness	ASTM C88	Loss after 5 cycles not more than 8 percent of coarse aggregate, nor more than 10 percent of fine aggregate
Abrasion	ASTM C131	Weight loss not more than 10.5 percent after 100 revolutions, 42 percent after 500 revolutions
Deleterious materials	ASTM C33	
Materials finer than No. 200 sieve	ASTM C117	Not over 1 percent for gravel, 1.5 percent for crushed aggregate
Reactivity potential	ASTM C227, C289, C342	Ratio of silica released to reduction in alkalinity not to exceed 1.0.
Sand equivalent	ASTM D2419	California sand equivalent values operating range not below 71 percent

- I. Compliance with Regulations: All materials shall comply with the current rules and regulations of the local air quality management district, with the rules regarding volatile organic compounds, and with FDA rules and regulations for dangerous substances in construction products.

1.5 CONCRETE MIX DESIGNS

- A. A registered civil engineer with experience in concrete mix design shall select the relative amounts of ingredients to be used as basic proportions of the concrete mixes proposed for use under the provisions of ACI 318 Section 26.4. Mixes shall be

based on existing approved compressive strength test data for concrete mixes in accordance with ACI 301 and requirements below:

- B. Strength Requirements: Design mixes for structural concrete for minimum 28-day compressive strengths required by Drawings and Specifications. The trial batch strength for each mix shall exceed indicated or specified strength by 750 psi or a lesser amount based on the standard deviations of strength test records according to ACI 318.
- C. Normal Weight Concrete Mix Design: Design all mixes for workability and durability of concrete. Control the mixes in accordance with ACI 301, ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete, and Section 26.4 of ACI 318, Building Code Requirements for Reinforced Concrete. Make adjustments in cement content required for concrete strengths at Contractor's expense and do not exceed 0.60 (or as indicated on concrete general notes of approved plans) absolute water-cement or cement plus fly ash ratio by weight. Do not use calcium chloride or any admix containing such material. Admixtures containing a material releasing nitrates in solution are limited to 0.06 percent by weight for the chloride ion.
- D. Maximum Aggregate Sizes: Not exceeding 3/4 of minimum clear space between bars and between bars and forms, nor larger than 1/5 of least dimensions between the forms.
- E. Design the mixes with 1" maximum size, except maximum 1-1/2" size for foundations and maximum 3/8" size at congested reinforcing or thin sections, as submitted by the contractor and approved by the Architect and Structural Engineer of Record.
- F. Light Weight Structural Concrete: Design mixes in accordance with ACI 301, and control mix in accordance with ACI 211.2, Standard Practices for Selecting Proportions for Structural Light Concrete. Design for air-dry density of 110 pounds per cubic foot maximum. With each mix design submit test reports showing concretes covered by the mix designs meet shrinkage test requirements specified under Article "Field Quality Control" hereinafter or include certified test reports showing conformance as furnished by the ready-mix concrete manufacturer.
- G. ACI 301 with test records. Where a testing laboratory acceptable to the enforcement agency has records of compressive strength tests, a standard deviation shall be established. Test records from which a standard deviation is calculated shall:
 - 1. Represent materials, quality control procedures and conditions similar to those expected, and changes in materials and proportions within the test records shall not have been more restricted than those for proposed work.
 - 2. Represent concrete produced to meet a specified strength or strengths $f'c$ within 1,000 psi of that specified for proposed work.
 - 3. Must consist of at least 30 consecutive tests or two groups of consecutive tests totaling at least 30 tests as defined in ACI 301.

1.6 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.
- C. Ready-mix concrete shall be mixed and delivered in accordance with ASTM C 94. Each batch of concrete delivered to the Project site shall be accompanied by a time slip bearing departure time and signature of batch plant supervisor. Concrete shall be placed within 90 minutes after start of mixing. Deliver all materials in timely manner to ensure uninterrupted progress of the work.

1.7 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. When placing concrete during freezing or near-freezing weather the mix shall have a temperature of at least 50 degrees F, but not more than 90 degrees F when cement is added. Concrete shall be maintained at a temperature of at least 50 degrees F. for at least 72 hours after placing or until it has thoroughly hydrated. When necessary, concrete materials shall be heated before mixing. Special precautions shall be provided for protection of transit-mixed concrete. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. Surfaces, in which concrete is to come in contact with, shall be free from frost or ice. No frozen materials or materials containing ice shall be furnished.
- B. Hot Weather Requirements: Batching, mixing, delivering and placing of concrete in hot weather shall comply with the applicable requirements of ACI 305R. During hot weather, proper attention shall be provided for ingredients, production methods, handling, placing, protection and curing, to prevent excessive concrete temperatures or water evaporation which could impair required strength or durability.
- C. Concrete temperature of freshly mixed concrete shall be determined per ASTM C1064.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement: ASTM C150. Portland Cement.
- B. Aggregates: Conform to the following standards:
 - 1. Normal weight concrete: ASTM C33
 - 2. Aggregate shall be tested for Potential Alkali Reactivity of Cement-Aggregate Combinations per ASTM C289.
 - 3. 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.
5. Aggregates shall be from approved pits, free from vegetable matter and of opaline, feldspar, or siliceous magnesium substances; all washed, clean, hard, fine-grained sound crushed rock or gravel; not over 5 percent by weight of flat, thin, elongated, friable, or laminated pieces (pieces having major dimension over 5 times average dimension) or more than 2 percent by weight of shale or cherty material. Any suitable individual grading of coarse aggregate may be furnished, provided Grading of Combined Aggregate indicated in following table is obtained. Refer to Section 01 4200: Testing and Inspection.

GRADING OF COMBINED AGGREGATE

Sieve Number or Size in Inches	1-1/2" Maximum	1" Maximum	3/4" Maximum
Passing a 2"	-----	-----	-----
Passing a 1-1/2"	95-100	-----	-----
Passing a 1"	70-90	90-100	-----
Passing a 3/4"	50-80	70-95	90-100
Passing a 3/8"	40-60	45-70	55-75
Passing a No. 4	35-55	35-55	40-60
Passing a No. 8	25-40	27-45	30-46
Passing a No. 16	16-34	20-38	23-40
Passing a No. 30	12-25	12-27	13-28
Passing a No. 50	2-12	5-15	5-15
Passing a No. 100	0-3	0-5	0-5

- 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 26.4.
 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. Pozzolan: ASTM C618, Class F Fly Ash subject to the conditions in ACI 318 Section 26.4, containing two percent or less carbon. Fly ash shall not be

used in excess of 15 percent by weight of total cement quantity for structural concrete. Fly ash need not be included in lightweight concrete mix designs.

6. Admixtures containing ASTM C845 expansive cements shall be compatible with the cement and produce no deleterious effects.
 7. Silica fumes used as an admixture shall conform to ASTM C1240.
 8. Chemical admixtures shall conform to ACI 318 Section 26.4.1.4, type A or D, manufactured by Grace or approved equal.
- 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 and ASTM D1752.
- 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, and non-staining. Liquid curing compounds may be substituted provided they are clear, conform to ASTM C 309, and comply with Rule II 13 of the South Coast Air Quality Management District and Federal Air Quality Regulation 40 CFR 52.254, such as Master Builders, Grace, Antihydro.
- H. Not Used
- I. Not Used
- J. Not Used
- K. Not Used
- 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.
- M. Construction Joint Materials: "Key-Kold" or "Kwik-Joint," of profiles indicated.
- N. Bonding Agent: "Weld-Crete," manufactured by Larsen Products Co., P.O. Box 2127, Rockville, MD 20852, Master Builders "Concresive," or equal.
- O. Epoxy Grout: Master Builders "Ceilcote 648," or equal. $f'c$ shall be equal to 125% of the concrete base design strength.
- P. Non-shrink grout:
1. For concealed areas: Master Builders "Embeco 885," or equal, non-gas-forming and free of oxidizing catalysts and inorganic accelerators, used as dry or damp pack, or mixed to a 20-second flow (CRC-C 611), without segregation or bleeding at any temperature between 45 degrees F and 100 degrees F. Working time 30 minutes or more. Grout shall be flowable with

an f'_c equal to 125% of the concrete base design strength.

2. For exposed areas: Master Builders "Masterflow 928," with same characteristics as specified for concealed areas.

- Q. Drypack: Field mixture of 1 part Portland cement to 2 parts fine aggregate mixed to a damp consistency such that a ball molded in the hands will stick together and hold its shape. In lieu of field mixing, Contractor may use factory mixed drypack material, such as Master Builders "Set Grout." f'_c shall be equal to 125% of the concrete base design strength.

2.2 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 ACI 301. Concrete mix shall meet the durability requirements of ACI 318, Chapter 19 and CBC Section 1905A.
- D. Concrete proportioning shall be determined on the basis of field experience and/or trial mixtures shall in accordance with ACI 301. 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. Furnish ready-mixed concrete from an approved commercial off-site plant. Use transit mixer trucks equipped with automatic devices for recording number of revolutions of drum, comply with ACI Chapter 5.
- F. Slump: Adjust quantity of water so concrete at point and time of placing does not exceed the slumps per plans when tested according to ASTM C143. Use the minimum water necessary for workability required by part of structure being cast.
- G. Admixtures: All approved admixtures shall be introduced into the concrete at the batch plant. Field additions are not acceptable.

PART 3 EXECUTION

3.1 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 IOR at least 24 hours before placing concrete; do not place concrete until inspected by the IOR.

- 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.

3.2 TOLERANCES

- A. Concrete construction tolerances shall be as specified in ACI 117 and as modified herein.
- B. Not Used
- C. Not Used
- D. Not Used

3.3 PREPARATION

- A. Not Used
- 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. Not Used
- D. Not Used
- E. Remove all free water from forms before concrete is deposited. Remove hardened concrete, debris, and foreign materials from interior surfaces of forms, exposed reinforcing, and from surfaces of mixing and conveying equipment.
- F. Wetting: Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce adsorption and to help maintain concrete workability.
- G. Earth Subgrade: Dampen 24 hours before placing concrete, but do not muddy. Re-roll where necessary for smoothness and remove loose material.
- H. Gravel Fill: Recompect disturbed gravel and bring to correct elevation.
- I. Sand Beds or Subslab Drainage Fill: Recompect disturbed material and bring to correct elevation.
- J. Not Used

K. Not Used

L. All 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.

3.4 INSTALLATION

A. Conveying and Placing:

1. Do not place concrete until reinforcing steel and forms or decks have been approved by the Inspector and other authorities having jurisdiction. Concrete shall be placed only under direct observation of the IOR. Do not place concrete outside of regular working hours, unless the IOR 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. Place concrete in horizontal layers not more than 18" thick within 90 minutes after water is first added to the batch.
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 5 feet for concealed concrete or over 3 feet for exposed concrete.
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 with mechanical vibrators and into corners of forms.
7. Where conditions make consolidation difficult, or where reinforcement is congested, batches of concrete adjusted to use smaller size aggregates than specified in the mix design shall be used as approved by the Architect and Structural Engineer.
8. Where new concrete is placed against or on old or existing concrete, apply bonding agent to surface of old concrete prior to placement of new concrete.
9. Comply with ACI 301.

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 301.
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.
3. Compacting: Compact each layer of the concrete as placed with mechanical vibrators or equivalent equipment. Transmit vibration directly to concrete and in no case through the forms unless approved. Accomplish thorough compaction. Supplement by rodding or spading by hand adjacent to forms. Compact concrete into corners and angles of forms and around reinforcement and embedded fixtures. Recompact deep sections with congestion due to reinforcing steel as required.

4. Operation of Vibrators: Do not horizontally transport concrete in forms with vibrators nor allow vibrators to contact forms or reinforcing. Push vibrators vertically into the preceding layers that are still plastic and slowly withdraw, producing maximum obtainable density in concrete without creating voids or segregation. In no case disturb concrete that has partially set. Vibrate at intervals not exceeding two-thirds the effective visible vibration diameter of the submerged vibrator. Avoid excessive vibration that causes segregation.

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.
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. Non-architectural 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 301.
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. Use the water curing method, curing sheet material, or a clear liquid membrane-forming curing compound except as otherwise specified.
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.
5. Within 24 hours after finishing, exterior slabs and paving, and interior slabs to receive cement topping or mortar setting beds, shall be covered with sand to a depth of 2 inches and kept thoroughly wet for 7 days. Instead of sand covering,

exterior walks and paving where no other surface treatment is specified, may be cured with clear liquid curing compound immediately installed in accordance with manufacturer's directions.

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.

I. Joints: Comply with ACI 318 Section 6.4. Locate joints in concrete only where shown or approved and obtain prior approval for points of stoppage of any pour. Clean and roughen surface of construction joints by removing entire surface and exposing 1/4" of clean coarse aggregate solidly embedded in mortar matrix by sandblasting, chipping, use of an approved retarder agent, or equal. Water and keep hardened concrete wet for not less than 24 hours before placing the next lift or abutting concrete. Cover the horizontal surfaces of existing or previously placed and hardened concrete with a 2" thick layer of fresh concrete of required mix less 50 percent of coarse aggregate just before balance of concrete is placed.

J. Vertical Elements: Stop placement of concrete in walls and columns 1-1/2" below bottom of beams or supported slabs. Stop placement at sills and heads of wall openings in the same manner. Allow concrete in vertical elements to be in place at least 2 hours and until vertical settlement has ceased before placing concrete for floor framing.

K. Correction of Segregation: Before placing next layer of concrete, and at the top of each placement for vertical elements, remove all concrete containing excess water or fine aggregate, or showing deficiency of coarse aggregate, and fill the space with compacted concrete of correct proportions. Comply with ACI 318 Section 6.4.

3.5 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. Abrasive grains in amount of 30 pounds per 100 square feet shall be evenly installed by dust-on method and embedded into surface during first troweling operation. Additional abrasive grains, in amount of 30 pounds per 100 square feet, shall then be evenly installed and embedded into surface during final troweling operation.
- E. Floor Hardener: Exposed interior concrete floors throughout shall be treated with floor hardener, as specified. Install hardener after surface of concrete has reached the point where no excess moisture is present, but while it is still plastic. Hardener shall be installed as follows:
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.
 3. Colored Hardener: Install at rate of 40 pounds per 100 square feet of surface for initial application.
 4. Gray (natural) Hardener: Install at rate of 20 pounds per 100 square feet of surface for initial application.
 5. Hardener shall be evenly distributed and thoroughly floated into surface mortar with a wood float. An additional 20 pounds of hardener, colored or gray, specified as above, shall be installed over each 100 square feet, and troweled to an even surface having uniform color and texture.

- 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.

3.6 GROUTING AND DRYPACKING

- A. Install as indicated or required. Where grouting and drypacking is part of the work of other sections, it shall conform to the following requirements, as applicable.
- B. Drypacking: Mix materials thoroughly with minimum amount of water. Install drypack by forcing and rodding to fill voids and provide complete bearing under plates. Finish exposed surfaces smooth and cure with damp burlap or liquid curing compound.
- C. Non-Shrink Grouting:
 - 1. Mixing: Mix the approved non-shrink grout material with sufficient water per manufacturers recommendations.
 - 2. Application: Surfaces to receive the non-shrink grout shall be clean, and shall be moistened thoroughly immediately before placing the mortar. Before grouting, surfaces to be in contact shall be roughened and cleaned thoroughly, all loose particles shall be removed and the surface flushed thoroughly with neat cement grout immediately before the grouting mortar is placed. Place fluid grout from one side only and puddle, chain, or pump for complete filling of voids; do not remove the dams or forms until grout attains initial set. Finish exposed surfaces smooth, and cure as recommended by grout manufacturer.

3.7 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 occurring on grade. Space approximately 20 feet apart (12 feet apart at traffic areas), 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 on grade, walks and paving on grade 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.

3.08 FIELD QUALITY CONTROL

- A. Comply with pertinent provisions of section 01 4200.
- B. Continuous Inspection: Construct structural concrete under continuous inspection of Project Inspector. Obtain approval of forms and reinforcing as required by the Inspector before placing structural concrete.
- C. Molded Cylinder Tests:
 - 1. IOR 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 3 days, 7 days, and 28 days. A strength test shall be the average of the compressive strength of 2 cylinders, obtained from the same sample of concrete and tested at 28 days or at test age designated for determination of f_c . Retain one additional cylinder from each location to be tested in the event that the initial 2 cylinder test does not meet the project requirements. High fly ash concrete mixes may be tested at 42 days in lieu of 28 days.
 - 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.
 - 4. Frequency of testing shall conform to ACI 318 Section 26.12 and CBC Section 1905A.1.16 as a minimum requirement.
 - 5. Control Test Cylinders: Cast a set of two or more cylinders for each day's placing of concrete for slabs supported on shoring. Place test cylinders on slabs represented by cylinders and cure the same as slabs. Test cylinders to determine proper times for removal of shores and reshoring. A strength test shall be the average of the compressive strengths of 2 cylinders made from the same sample of concrete and tested at 28 days.

- D. Concrete Consistency: Measure consistency according to ASTM C143. Test twice each day or partial day's run of the mixer.
- E. 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.
- F. Air Content Testing: Measure in accordance to ASTM C173 or ASTM C231, for each composite sample taken in accordance to ASTM C172.
- G. 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.
- H. 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 Forms and Accessories, and reinforced as described in Section 03 2000: Concrete Reinforcement. 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 $\frac{3}{4}$ inch maximum aggregate.
- I. Level of Floors: Continuously monitor concrete placing to maintain level floor by use of an instrument level, transit, or laser.

3.9 CLEAN UP

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

3.10 PROTECTION

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

END OF SECTION

SECTION 05 0513
HOT-DIP GALVANIZING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Hot-dip galvanizing of structural steel articles.
2. Hot-dip galvanizing of steel stairs and railings.
3. Hot-dip galvanizing of fabricated steel assemblies.
4. Hot-dip galvanizing of fencing steel assemblies.
5. Preparation of galvanized steel assemblies for painting.

B. Related Sections:

1. Division 01 - General Requirements.
2. ~~Section 05 1200: Structural Steel Framing.~~
3. Section 05 5000: Metal Fabrications.
4. ~~Section 05 5100: Metal Stairs and Railings.~~
5. ~~Section 09 9000: Painting and Coating.~~

1.02 REFERENCES

A. American Galvanizers Association (AGA):

1. Inspection of Products Hot-dip Galvanized after Fabrication.
2. The Design of Products to be Hot-dip Galvanized after Fabrication.
3. Recommended Details of Galvanized Structures.

B. ASTM International (ASTM):

1. ASTM A123 – Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
2. ASTM A143 – Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

3. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A384 – Standard Practice for Safeguarding Against Warpage and Distortion during Hot-Dip Galvanizing of Steel Assemblies.
5. ASTM A385 – Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
6. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
7. ASTM B6 – Standard Specification for Zinc.
8. ASTM D6386 – Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
9. ASTM D7803 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating.
10. ASTM E376 - Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods.

C. The Society for Protective Coatings (SSPC):

1. SSPC-SP1 – Solvent Cleaning.
2. SSPC-SP2 – Hand Tool Cleaning.
3. SSPC-SP3 – Power Tool Cleaning.
4. SSPC-SP5 – White Metal Blast Cleaning.
5. SSPC-SP7 – Brush-Off Blast Cleaning.
6. SSPC-SP10 – Near White Blast Cleaning.
7. SSPC-SP11 – Power Tool Cleaning to Bare Metal.
8. SSPC-SP16 - Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.

1.03 COORDINATION WITH STEEL FABRICATOR

- A. Prior to fabrication, steel fabricators shall submit approved fabrication shop drawings to the galvanizer. The Galvanizer shall review fabricator shop drawings for suitability of materials for galvanizing and coatings and coordinate any required fabrication modifications.
- B. Steel Fabricator shall notify the galvanizer of steel fabrications that exceed the ASTM A385 recommended percentages for carbon, phosphorus, manganese and silicon, so special galvanizing processing techniques are used.

- C. Coordinate with steel fabricator appropriate marking and masking materials.

1.04 QUALITY ASSURANCE

- A. Coating Applicator: Company specializing in hot-dip galvanizing after fabrication following the procedures in the Quality Assurance Manual of the American Galvanizers Association.
- B. Galvanizer shall have an in-plant inspection program designed to maintain the coating thickness, finish, and appearance within the requirements of this Section.

1.05 SUBMITTALS

- A. Galvanizing Certificate of Compliance: Provide notarized Certificate of Compliance with ASTM standards and specifications herein listed. The Certificate shall be signed by the galvanizer and contain a detailed description of the material processed. The Certificate shall include information as to the ASTM standard used for the coating.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Package and handle galvanized material in a manner which will avoid damage to the zinc coating.
- B. Store in dry, well-ventilated conditions until shipping.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel for Galvanizing: As specified in Sections:
 - 1. ~~Section 05 1200: Structural Steel Framing.~~
 - 2. Section 05 5000: Metal Fabrications.
 - 3. ~~Section 05 5100: Metal Stairs and Railings.~~
- B. Zinc for Galvanizing: Conform to ASTM B6, as specified in ASTM A123.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Remove welding slag, splatter, anti-splatter compounds and burrs remaining in steel articles.
- B. Provide drainage and venting holes in tubular assemblies. In thicker material drill holes in place of punching. Holes shall have a relatively uniform circumference. Punched

holes or burned holes with a plasma torch shall be treated with a drill to even the diameter to appropriate size.

- C. Masking installed by steel fabricator shall remain in place through galvanizing process completion.
- D. Provide lifting lugs to allow for handling during galvanizing. Avoid the use of chains or wires directly connected to steel articles.
- E. Safeguard against warpage or distortion of steel members in accordance with ASTM A384.
- F. Pre-clean steel work in accordance with accepted methods to produce an acceptable surface for quality hot-dip galvanizing. Remove surface contaminants and coatings that are not removable by the normal chemical cleaning process in the galvanizing operation by grit-blasting, sand-blasting, or other mechanical means.
- G. Follow the degreasing, pickling and fluxing steps to remove remaining oxides and to deposit a protective layer on the steel to prevent any further oxides from forming on the surface prior to immersion in the molten zinc.

3.02 COATING APPLICATION

- A. Galvanize steel articles, fabrications and assemblies by the hot-dip process in accordance with ASTM A123. The bath chemistry shall be as specified by ASTM B6, and requires at least 98% pure zinc maintained at approximately 840 F.
- B. Galvanize bolts, nuts, washers and iron and steel hardware components in accordance with ASTM A153.
- C. Safeguard products against steel embrittlement in conformance with ASTM A143.
- D. Once the fabricated items' coating growth is complete, withdraw slowly from the galvanizing bath, and remove the excess zinc by draining, vibrating, and/or centrifuging.
- E. Prepare galvanized products for powder coating in accordance to ASTM D7803. Prepare galvanized products for painting in accordance to ASTM D6386.
- F. Handle articles to be galvanized in such a manner as to avoid mechanical damage and to minimize distortion.
- G. Apply a chromate passivation treatment to fabrications that will not be painted after galvanizing to minimize the wet storage staining which may occur on articles unable to be stored in dry, well-ventilated conditions.

3.03 COATING REQUIREMENTS

- A. Conform to paragraph 6.1 of ASTM A123, or Table 1 of ASTM A153, as applicable.
- B. Surface Finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article

- C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

3.04 TESTS

- A. Inspection and testing of hot-dip galvanized coatings shall be done under the guidelines provided in the AGA publication Inspection of Products Hot-dip Galvanized after Fabrication. Tests and inspections shall be performed immediately after the coating is applied and has cooled to ambient temperature, and before it leaves the galvanizing facility.
- B. Include visual examination and test methods in accordance with ASTM A123, or A153, as applicable, to determine the thickness of the zinc coating on the metal surface.
- C. During the visual inspection, if adhesion concerns are suspected, such as peeling or flaking of the galvanized coating, then adhesion testing using the stout knife method shall be conducted. Embrittlement testing is required when there is evidence of embrittlement and shall be conducted per the requirements of ASTM A143.
- D. Upon completion of tests furnish notarized Certificate of Compliance with ASTM standards and specifications herein listed.

3.05 REPAIR OF DAMAGED COATINGS

- A. Smooth out rough surfaces, bumpy or high spots and icicles by hand filing or power sanding the area without removing any more zinc coating than necessary. Repair damaged galvanized surface with a zinc rich coating.
- B. Repair areas damaged during galvanizing process or handling by one of the approved methods in accordance with ASTM A780 whenever damage exceeds 3/16" in width. Minimum thickness requirements for the repair shall be per ASTM A123, Section 6.2.
- C. Remove lifting lugs and repair coating with a zinc rich coating.
- D. Surface preparation for application of zinc rich coating shall be in accordance to ASTM A780.
 - 1. Clean areas in accordance to SSPC-SP2.
 - 2. Prepare surface for zinc spray in accordance to SSPC-SP5, or zinc rich paint repair in accordance to SSPC-SP10.

3.06 PREPARATION FOR TOP COATING

- A. Galvanized fabrications indicated on the drawings to be painted shall be prepared in accordance to ASTM D6836.

1. Surface cleaning prior to surface preparation in accordance to SSPC-SP1.
 2. Removal of zinc high spots and cleaning of light deposits of zinc reaction products in accordance to SSPC-SP2 or SSPC-SP3.
 3. Profile surface in accordance to SSPC-SP7 or SSPC-SP11.
- B. Galvanized fabrications indicated on the drawings to be powder coated shall be prepared in accordance to ASTM D7803.
1. Surface cleaning and removal of oil and grease in accordance to SSPC-1.
 2. Surface smoothing and removal of loose particles in accordance to SSPC-SP-2 or SSPC-SP3.
 3. Sweep blasting and surface profiling in accordance to SSPC-SP16.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Metal fabrications:

1. Steel thresholds.
2. Steel ladders and ladder safety cages.
3. Elevator hoist way door sill angles,
4. Steel framing and supports for countertops.
5. Steel tube reinforcement for low partitions.
6. Steel framing and supports for mechanical and electrical equipment.
7. Steel Gates.
8. Gratings, frames and covers.
9. Rooftop mechanical screening.
10. Steel bollards.
11. Embedded edge angles in concrete.
12. Steel supports for coiling doors.
13. Miscellaneous steel framing, supporting angles, plates, brackets, clips, anchors and bolts for equipment, and other work which is not specifically included in Section 05 1200, Structural Steel Framing.
14. Miscellaneous fabrications, including metal guardrail systems, as indicated on the Drawings.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4523: Testing and Inspection.
3. Section 03 3000 – Cast-in-Place Concrete.
4. Section 05 5013: Hot-Dip Galvanizing.

A. Codes:

1. ADA – Americans with Disability Act of 1990
 - a. ADA Standards – ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.
2. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC) Volumes 1 and 2022 Edition.

B. ASTM International (ASTM):

1. ASTM A27 – Standard Specification for Steel Castings, Carbon, for General Application.
2. ASTM A36 – Standard Specification for Carbon Structural Steel.
3. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
4. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
5. ASTM A123 - Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
7. ASTM A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
8. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
9. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
10. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
11. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
12. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
13. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

14. ASTM D1187 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
15. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
16. ASTM F2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

C. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code - Steel.
2. AWS D1.3 Structural Welding Code - Sheet Steel.
3. AWS D-19.0 Welding Zinc Coated Steel.

1.03 COORDINATION

A. Coordination between Steel Fabricator and Galvanizer:

1. Prior to fabrication, submit approved fabrication shop drawings to the galvanizer.
2. Notify galvanizer of steel fabrications that exceed the ASTM A385 recommended percentages for carbon, phosphorus, manganese and silicon, so special galvanizing processing techniques are used.

B. Coordinate installation of metal fabrications that are anchored to concrete or masonry, or that receive work specified by other Sections. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

C. Field Measurements: Field verify dimensions prior to fabrication.

D. Coordinate selection of shop primers with galvanizing, and with paintings to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and paintings are compatible with one another.

1.04 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings indicating provided materials, dimensions, anchoring detail, and details of termination or connection to adjacent construction. Indicate items that are purchased from a manufacturer and items that are shop fabricated. Indicate component parts requiring Project site fabrication or assembly.
- B. Product Data: Submit Product Data for manufactured items. Submit Product Data for primers and finishes.

- C. Material Samples: Submit Samples of primers and finishes on fabricated items.
- D. Fabricator qualifications per Article “Quality Assurance”.
- E. Welding:
 - 1. Welder’s Certificates: Field welders shall be Project certified in accordance with AWS D1.1.
 - 2. Welding Material Certification: Provide certificate that welding material complies with specifications.
- F. Research/Evaluation Reports: ICC-ES for post-installed anchors.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm with a minimum five year experience in successfully producing metal fabrications similar to that shown on the drawings.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D-1.1– Structural Welding Code – Steel.
 - 2. AWS D1.3 - Structural Welding Code - Sheet Steel.
- C. Inspection of Welding: Refer to Section 01 4523: Testing and Inspection.
- D. Field applied primers, paintings, sealers and adhesives shall be approved by the OWNER’s Office of Environmental Health and Safety (OEHS).
- E. Preassemble items in shop to greatest extent possible to minimize field welding. Mark units for reassembly and coordination of installation. Use marking method compatible with galvanizing.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Store miscellaneous metal items above grade on platforms, skids, or other required supports.
- B. Protect from damage and from corrosion, dirt, grease and other foreign matter.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Steel Shapes: ASTM A36.

- B. Rolled Steel Plates: ASTM A36. Plates to be bent or cold-formed shall conform to ASTM A283, Grade C.
- C. Round HSS: ASTM A500 Grade B or C.
- D. Square and Rectangular HSS: ASTM A500 Grade B or C.
- E. Steel Pipe: ASTM A53 Type E or S, Grade B, standard weight (Schedule 40), unless otherwise noted. Black finish.
- F. Steel Sheet: ASTM A1008 or ASTM A1011.
- G. Guardrail panels: custom-perforated ¼” galvanized steel plate with powder coated finish.
 - i. Basis of Design: pattern = “164 – Metro”, finish color = “White-River” by Artisan Panels, Inc. 880W. Crowther Ave. Placentia, CA 92870 (Mark Tierheimer 714-351-3234)
 - ii. Or approved equal.
- H. Steel Bolts: ASTM A307, Grade A, or F3125 with hex steel nuts per ASTM A563 and washers. Galvanized in accordance with ASTM A153 for exterior locations.
- I. Steel Bars: Conforming to ASTM A108 or ASTM A575.
- J. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, and shims, hot-dip galvanized per ASTM A153.
- K. Nonshrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- L. Concrete Materials:
 - 1. Concrete per Section 03 3000, Cast-in-Place Concrete.
 - 2. Welded wire fabric and reinforcing per section 03 2000, Concrete Reinforcing.

2.02 FABRICATION

- A. General:
 - 1. Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces. Mark units for reassembly and installation.
 - 2. Cut, drill, and punch metals cleanly and accurately. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated or specified. Remove sharp and rough areas on exposed surfaces. Form exposed work with

accurate angles and surfaces and straight edges. Form exposed connections with hairline joints, flush and smooth. Locate joints where least conspicuous.

B. Welding:

1. Weld connections unless otherwise indicated.
2. Weld corners and seams continuously and in accordance with requirements of AWS D1.1 Structural Welding Code.
3. Grind exposed groove welds smooth and flush to match and blend with adjoining surfaces.

2.03 PREPARATION FOR GALVANIZING

- A. Fabricate to the largest size possible and whenever possible use slip joints to minimize field welding.
- B. Fabricate structural steel in accordance with Class I, II, III guidelines as described in AGA's Recommended Details for Galvanized Structures, to facilitate galvanizing process. Corners of gussets, stiffeners, and bracing shall be cropped to allow free flow of zinc during galvanizing process.
- C. Remove welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing.
- D. Marking for Identification: Avoid unsuitable marking paints for identification, such as oil based paints and markers and crayon markers. Use water soluble paints or markers acceptable to galvanizer or steel tags wired to the work.
- E. Masking: Use masking materials recommended by the American Galvanizers Association (AGA) to produce ungalvanized areas for field welding and at slip critical bolts.
- F. Galvanize fabrications per Section 05 5013, Hot-Dip Galvanizing, in accordance with ASTM A123 and ASTM A153.

2.04 SHOP FINISH

- A. Metal fabrications shall be provided with a coat of primer, except those indicated to be hot-dip galvanized.
- B. Primers:
 1. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
 2. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

3. Minimum dry film thickness of primer shall be 2.0 mils.
- C. Preparation for Primer Painting: Miscellaneous ferrous metal, except items specified galvanized, shall be thoroughly cleaned and prepared for painting, including removal of shipping oils or protective coatings, mill scale, grease, dirt and rust. Prepare in accordance with SSPC recommendations. Deliver to Project site primed or galvanized as indicated, and ready to receive Project site applied finishes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the areas where metal fabrications are to be installed. Notify the OAR in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Provide anchorage devices and fasteners as indicated in the drawings and where necessary for securing miscellaneous metal fabrications to in-place construction.
- B. Cut, drill, and fit as required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of hot-dip galvanized fabrications intended for bolted or screwed field connections.
- D. Alignment: Verify alignment of items with adjacent construction. Coordinate related work.
- E. Grout: Follow manufacturer's recommendations for substrate preparation and application.
- F. Corrosion Protection: Coat concealed surfaces of metals that will come into contact with grout, concrete, masonry, or wood, with a heavy coat of bituminous paint or zinc chromate primer. Protect dissimilar metals from galvanic corrosion by pressure tapes, coating, or isolators.

3.03 FIELD WELDING

- A. Preparation of Weld Area of Galvanized Fabrications: Remove masking from fabrications. Remove remaining zinc coating between one inch and four inches from both sides of members to be welded, by grinding back the zinc coating, burning the zinc away or pushing back the molten zinc from the weld area.

- B. Welding: Comply with AWS Code for procedures of manual shielded metal-arch welding, appearance and quality of welds made, methods used in correcting welding work.
 - 1. Weld in accordance to AWS D-1.1.
 - 2. Weld galvanized fabrications in accordance to AWS WZC D19.0.
- C. Remove welding flux immediately. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surfaces matches those adjacent.
- D. Upon completion of welding plug vent, drainage and lifting holes of galvanized fabrications with appropriate diameter zinc plugs. Push in about half way by hand, and hammer to a tight fit. With a hand file or an abrasive tool, file away excess material. Repair scratches with a zinc rich coating.
 - 1. Plug railing holes.
 - 2. Plug visible holes of HSS members.

3.04 ADJUSTING AND CLEANING

- A. Touch Up Damaged Surfaces:
 - 1. Shop Painted Finishes: Comply with SSPC-PA-1 for touch-up; apply with brush to produce a minimum 2.0 mil dry film thickness.
 - 2. Galvanized Surfaces: Clean field welds, connections and damaged areas. Apply two coats of Carbomastic 15, by Carboline or equal product approved by OWNER's OEHS. Brush or roll to a 4 to 6 mil thickness.

3.05 CLEAN UP

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

3.06 PROTECTION

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

END OF SECTION

SECTION 07 1326

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Sheet waterproofing in locations indicated including:
 - 1. Sheet waterproofing on vertical walls below grade enclosing occupied spaces.
 - 2. Sheet waterproofing in planters.
 - 3. Drainage sheets and protection boards.
- B. Related Requirements:
 - 1. Division 01 - General Requirements.
 - 2. Section 03 3000 - Cast-In-Place Concrete.
 - 3. Section 07 0800 - Commissioning of Thermal and Moisture Protection.
 - 4. Section 07 1400 - Fluid Applied Waterproofing.
 - 5. Section 07 1413 - Hot Fluid Applied Rubberized Asphalt Waterproofing.
 - 6. Section 07 2100 - Thermal Insulation.

1.02 SUBMITTALS

- A. Certificates: Submit a certificate stating applicator is certified by the waterproofing material manufacturer and, upon completion, submit a certificate stating that waterproofing systems have been installed in conformance with reviewed submittals and manufacturer's recommendations.
- B. Product Data: Submit manufacturer's Product Data including complete installation instructions.
- C. Shop Drawings: Submit Shop Drawings indicating each condition of the Work. Indicate all adjoining Work, and indicate methods of adhesion and attachment, laps, and related conditions.
- D. Samples: Submit Samples, not less than 12-inch square, of each type of composite sheet membrane, mounted on plywood. Submit 12-inch square Samples of each type of drainage and protection board.

- E. Experience Record: Submit a list of at least five installations on which each of the materials and systems proposed for installation have been in satisfactory service for at least three years.
- F. Commissioning Services Provider (CxSP) will review the Submittals of this Section as part of the Commissioning of Thermal and Moisture Protection.

1.03 QUALITY ASSURANCE

- A. References:
 - 1. ASTM D6506 - Standard Specification for Asphalt Based Protection for Below-Grade Waterproofing.
 - 2. ASTM D6135 - Standard Practice for Application of Self-Adhering Modified Bituminous Waterproofing.
 - 3. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
 - 4. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- B. Qualifications of Manufacturer: Sheet membrane waterproofing system shall be manufactured by a firm with a minimum of 20 years experience in the production of self-adhesive sheet membrane waterproofing.
- C. Qualifications of Installer: A firm which has at least three years experience in work of the type required by this section and is recommended by manufacturer to install the specified products.
- D. Pre-Installation Conference and Inspection: After review of submittals but before starting installation of the Work of this section, conduct a meeting at the Project site attended by the Project Inspector, Architect, OAR, Contractor waterproofing applicator and a technical representative of the waterproofing material manufacturer. The waterproofing applicator and material manufacturer's technical representative shall inspect the substrates to receive Work of this section and report defective conditions to Project Inspector, Architect, OAR and Contractor.
- E. Manufacturer's Representative: Provide arrangements necessary to have a trained representative of the manufacturer visit the Project site on a weekly basis during membrane waterproofing Work to review installation procedures.
- F. Materials shall comply with current State of California and local Air Quality Management District requirements for volatile organic compounds of not over 350 grams per liter.
- G. Commissioning:

1. Commissioning Services Provider (CxSP) retained by the OWNER shall perform Commissioning (Cx) of building envelope systems and assemblies, including review of submittals, installation compliance, and training materials. CxSP shall witness training and collect all materials for inclusion in the commissioning report. All Cx services shall be in compliance with the requirements indicated in Section 07 0800, Commissioning of Thermal and Moisture Protection.
2. CONTRACTOR shall follow the commissioning responsibilities stated in Section 01 9113, General Commissioning Requirements.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's unopened packages fully identified with manufacturer's name, trade name, type, class and grade. Each package shall be identified with material name, date of manufacturer and batch number.
- B. Store materials at the Project site under cover and maintain in dry condition. Protect from damage from excessive temperature and construction operations. Do not double-stack pallets of membrane. Protect mastic and adhesive from moisture and excessive heat.
- C. Store drainage composite or protection board flat and above grade. Provide cover on top and all sides of pallets and provide for adequate ventilation. Protect surface conditioner from freezing.

1.05 PROJECT CONDITIONS

- A. Install suitable impervious type masking to preclude staining of surfaces to remain exposed wherever waterproofing abuts or laps on to other finish surfaces, and provide additional protection as necessary to supplement masking; cover entire area of building subject to damage or staining.
- B. Protect adjacent Work during installation of Work of this Section.
- C. Apply sheet waterproofing materials only in dry weather and when outside temperature is within the limits established by the manufacturer of the materials and products used.
- D. Do not apply sheet waterproofing materials to damp or wet surfaces unless specifically approved in writing by manufacturer.

1.06 WARRANTY

- A. Manufacturer shall provide a five year material warranty.
- B. Installer shall provide a five year labor warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Sheet waterproofing shall be as manufactured by:

1. W.R. Grace & Co.
2. W.R. Meadows, Inc.
3. Protecto Wrap Company.
4. Equal.

2.02 MATERIALS

- A. Sheet waterproofing material shall be self-adhesive, cold-applied such as W.R. Grace Bituthene 4000, W.R. Meadows Mel-Rol, Protecto Wrap PW 100/60, or equal. The material shall be a self-adhesive, cold-applied composite sheet consisting of a thickness of 0.056 inches of rubberized asphalt and 0.004 inches of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet, which is removed during installation. No special adhesive or heat shall be required to form laps.
- B. Surface conditioner: Latex based surface conditioner as recommended by manufacturer
- C. Adhesives fillets and sealers: Types as recommended by manufacturer for installation with specified membrane sheet.
- D. Prefabricated Drainage Sheet:
1. For vertical surfaces: Hydroduct 220, Mel-Drain 5035B, Protecto Drain 2000-V, or equal, consisting of a dimpled high impact polystyrene core and a needle punched non-woven filter fabric adhered to one side of the core. A film shall be adhered to the other side of the core.
 2. For horizontal surfaces: Hydroduct HSF, Mel-Drain 7555, Protecto Drain 2000-V, or equal, consisting of dimpled high impact polystyrene core and an extra heavy woven filter fabric bonded to the core.
- E. Protection board for horizontal surfaces shall be 1/8 inch thick complying with ASTM D6506, semi-rigid sheets of fiberglass or mineral-reinforced asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspect and verify condition of substrates and related Work, in the presence of the manufacturer's technical representative. Do not start installation of membranes until

defects in substrates have been corrected. Concrete shall be smooth, dry, and free of voids. Masonry shall have a parge coat applied.

3.02 APPLICATION OF MEMBRANE ON VERTICAL WALLS BELOW GRADE ENCLOSING OCCUPIED SPACES AND IN PLANTERS

- A. Surface Conditioning: Install surface conditioner and allow to dry to surfaces to be covered with membrane the same day.
- B. Corner Treatment: Pretreat inside corners with liquid membrane compound, to form a fillet or use formed reinforcement fillet recommended by manufacturer. Smooth all surfaces of outside corners.
- C. Horizontal Surfaces: Install nine inch wide strips of membrane material over construction joints, cracks, and grouted joints. Seal expansion joints as recommended by manufacturer. At drains and vertical projections, install two layers of membrane sheet extended out not less than 6 inches in all directions, and seal. At drains, extend the membrane into the clamping ring and seal. Over prepared surfaces install membrane in one layer and roll into place. Lap sheets 2-1/2 inches at edges and ends.
- D. Vertical Surfaces: Install membrane vertically in heights to 8 feet. Lap seams 2 ½ inches. Roll membrane with hand roller. Extend membrane over top of foundation walls, planter walls and parapet walls, except where reglets are provided for termination.

3.03 PREFABRICATED DRAINAGE SHEET

- A. Vertical Surfaces: Install rolls of vertical drainage sheet over the completed membrane, starting at the base of the wall. Peel the fabric back approximately 12 inches from the lower edge. Where drainage pipe occurs, install the drain core behind the pipe and extend the fabric over the outside of the pipe. Adhere the drainage sheet to the wall using strips of adhesive as recommended by manufacturer.
- B. Horizontal Surfaces: Adhere the drainage sheet to the membrane with strips of adhesive. Butt adjacent panels together and overlap fabric onto the previous panel. At corners, cut the core and cover the core with filter fabric or tape.

3.04 COMPOSITE STRIP WATERPROOFING

- A. Provide at sills, copings, eaves, ridges, and under other flashing as indicated. Do not fold over exposed edges. Prime concrete and masonry surfaces as recommended by manufacturer. Cut the membrane into 10 to 15-foot lengths and reverse roll. Separate membrane from release paper, press firmly into place, and roll to eliminate bubbles and assure full adhesion. Lap sides of sheets not less than 3.5 inches and ends not less than 6 inches.

3.05 HIGH TEMPERATURE RESISTANT UNDERLAYMENT

- A. Seal joints in insulation as recommended by manufacturer. Prime insulation at rate of one gallon per 500 square feet if recommended by manufacturer. Over prepared surfaces install membrane in one layer and roll into place. Lap sheets 3 ½ inches at edges and 6 inches at ends. Roll firmly into place to obtain full adhesion of sheets to substrate.

3.06 APPLICATION OF MONOLITHIC MEMBRANE FOR ALL SUBSTRATES OTHER THAN CONCRETE

A. Membrane Application:

1. Install the rubberized asphalt membrane at a rate to provide a continuous, monolithic coat of 90 mil, into which is fully embedded a layer of spunbound polyester fabric reinforcing sheet, followed by another continuous monolithic coat of membrane at a minimum thickness of 125 mils. Total membrane thickness to be provided is 215 mils.
2. Overlap fabric reinforcing sheet 1 to 2 inches with membrane between sheets.

3.07 PROTECTION BOARD

- A. Cover all surfaces, vertical and horizontal, with protection board, unless indicated otherwise. Install with adhesive recommended by manufacturer, and compatible with membrane materials.

3.08 TESTS OF MEMBRANES

- A. Horizontal membranes shall be subjected to standing water test after completion, but before protection board is applied. Tests shall be conducted as soon as possible after completion of membrane in each area. When membrane installation is completed, seal drain, sandbag perimeter, fill membrane with water to height of not less than 2 inches, pond test for not less than 24 hours, repair all leaks or defects disclosed, and test until results are satisfactory. Remove all sandbags, plugs and drain when testing is completed. Clean surfaces of membrane.

3.09 PROTECTION

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

3.10 CLEANUP

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

END OF SECTION

SECTION 07 1400

FLUID APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Elastomeric waterproofing and drainage board.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 33 4000 - Storm Drainage Utilities.
3. Section 03 3000 - Cast-in-Place Concrete.

1.02 SUBMITTALS

- A. Certificates: Submit a certificate stating applicator is certified by the elastomeric waterproofing material manufacturer, and upon completion, submit a certificate stating that elastomeric waterproofing systems have been installed in conformance with reviewed submittals and manufacturer's recommendations.
- B. Product Data: Submit manufacturer's Product Data including complete installation instructions.
- C. Shop Drawings: Submit Shop Drawings indicating each condition of the Work. Indicate all adjoining Work, and indicate methods of adhesion, attachment, and related conditions.
- D. Samples: Submit Samples of elastomeric membrane waterproofing on flat plywood board, not less than 12 inches square, illustrating color and texture.
- E. Experience Record: Submit a list of at least five installations on which each of the materials and systems proposed for installation have been in satisfactory service for at least three years.

1.03 QUALITY ASSURANCE

A. References:

1. ASTM D6506, Standard Specification for Asphalt Based Protection for Below-Grade Waterproofing.

- B. Qualifications of Manufacturer: Elastomeric waterproofing system shall be manufactured by a firm with a minimum of 20 years experience in the production of elastomeric waterproofing.
- C. Qualifications of Installer: A firm which has at least three years experience in work of the type required by this section, and is recommended by manufacturer to install the specified products.
- D. Pre-Installation Conference and Inspection: After review of submittals but before starting installation of the Work of this section, conduct a meeting at the Project site attended by the Project Inspector, Architect, OAR, Contractor, waterproofing applicator, and a technical representative of the elastomeric waterproofing material manufacturer. The waterproofing applicator and material manufacturer's technical representative shall inspect the substrates to receive Work of this section and report defective conditions to Project Inspector, Architect, OAR and Contractor.
- E. Manufacturer's Representative: Provide arrangements necessary to have a trained representative of the manufacturer visit the Project site on a weekly basis during elastomeric waterproofing Work to review installation procedures.
- F. Materials shall comply with current State of California and local Air Quality Management District requirements for volatile organic compounds of not over 350 grams per liter.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's unopened containers fully identified with manufacturer's name, trade name, type, class and grade. Each container shall be identified with material name, date of manufacturer and batch number.
- B. Store materials at the Project site under cover and maintain in dry condition. Protect from damage from excessive temperature and construction operations. Do not double-stack containers. Protect mastic and adhesive from moisture and excessive heat.
- C. Store drainage composite or protection board flat and above grade. Provide cover on top and all sides of pallets and provide for adequate ventilation. Protect surface conditioner from freezing.

1.05 PROJECT CONDITIONS

- A. Install suitable impervious type masking to preclude staining of surfaces to remain exposed wherever elastomeric waterproofing abuts or laps on to other finish surfaces, and provide additional protection as necessary to supplement masking; cover entire area of building subject to damage or staining.
- B. Protect adjacent Work during installation of Work of this Section.
- C. Install Work of this section, only in dry weather and when outside temperature is within the limits established by the manufacturer of the materials and products used.

- D. Do not install any materials when water in any form is present on the surface or if materials are wet.

1.06 WARRANTY

- A. Manufacturer shall provide a three year material warranty.
- B. Installer shall provide a three year labor warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Elastomeric waterproofing shall be a single-component, upolyurethane waterproofing: Comply with ASTM C836.
 - 1. Tremco Inc., Tremproof 250GC.
 - 2. Equal.

2.02 MATERIALS

- A. Tremco Tremproof 250GC, as a standard of quality, conforming to the following:
 - 1. Application:
 - a. 60 mils thick – smooth surfaces.
 - b. 90 mils thick – rough surfaces.

2.03 RELATED MATERIALS

- A. Sealants: Compatible with waterproofing materials as recommended by manufacturer.
- B. Backer Rod: Closed-cell Polyethylene rod.
- C. Flashing Tape: Woven glass cloth tape.
- D. Protection Course: Tremco Protection Mat, or equal.
- E. Drainage Board: Tremdrain 2000NW, or equal.
- F. Cleaning Materials: Solvent recommended by manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Surfaces must be clean and free of any oil, dirt, grease, and other contaminants, which will interfere with adhesion of the coatings. Surfaces shall be left broom clean.
- B. Concrete:
 - 1. Concrete surfaces shall be trowel finished followed by a light brooming, left free of loose particles, ridges, projections, voids and droppings that would interfere with the application of the coatings.
 - 2. Concrete surfaces shall be water cured in lieu of curing compounds for a minimum of 28 days. If curing compounds are furnished, they shall be compatible with the provided waterproofing system.
- C. Substrate conditions and surfaces shall be subject to inspection by the manufacturer and installer. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect building from damage resulting from spillage, dripping and dropping of materials. Prevent materials from entering and clogging drains and waterways.
- B. Concrete
 - 1. Surfaces to receive elastomeric waterproofing system shall be cleaned by sandblasting or acid etching. If acid etching is provided, a 10 percent to 15 percent muriatic acid solution applied by mop or broom, shall be allowed to remain on the surface approximately 10 minutes or until bubbling ceases. Surfaces shall then be washed with clean water to remove residues and shall be allowed to dry.
- C. Cracks and Control Joints
 - 1. Except for non-moving shrinkage cracks, all other cracks and joints must be sealed with a single component sealant of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer's recommendations.
 - 2. Large cracks, 1/16 inch and over, shall be routed out as required by the manufacturer and sealed with an elastomeric sealant. Apply sealant to inside area of cracks only. Do not install on concrete deck surfaces.
 - 3. Seal secondary control and expansion joints with sealant and backer rod as recommended in the installation specifications of the elastomeric membrane waterproofing.

3.03 INSTALLATION

- A. Install Elastomeric membrane waterproofing in accordance with manufacturer's printed instructions except as hereinafter specified. Coordinate the Work so the

complete membrane is installed in a continuous operation, and that all areas where installation has started, per coat, are completed the same working day.

B. Elastomeric Membrane Waterproofing - 60 mils thickness, Smooth Surface Installation:

1. Cracks 1/16 inch and over shall be routed or saw cut and filled with joint filler of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer's recommendations.
2. At intersections of membrane and vertical walls, columns, pipes, and other penetrations, install a 3/4 inch fillet bead at the meeting angle using a joint filler of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer's recommendations.
3. Install the first coat of the elastomeric membrane waterproofing at a rate of 50 square feet per gallon by airless spray, roller, brush, or squeegee according to the manufacturers installation procedures for smooth surfaces.
4. After a 24 hour curing period, install a second coat of elastomeric membrane waterproofing at the same 50 square feet per gallon rate to provide a total dry film thickness of 60 mils.

C. Elastomeric Membrane Waterproofing -- 90 mils thickness, Rough Surface Installation:

1. Cracks 1/16 inch and over shall be routed or sawcut and filled with joint filler of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer's recommendations.
2. At intersections of membrane and vertical walls, columns, pipes and other penetrations, install a 3/4 inch fillet bead at the meeting angle using a joint filler of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer's recommendations.
3. Install the first coat of elastomeric membrane waterproofing at a rate of 35 square feet per gallon by airless spray, roller, brush, or squeegee according to the manufacturers installation procedures for rough surfaces.
4. After a 24 hour curing period, install a second coat of elastomeric membrane waterproofing at the same 35 square feet per gallon rate to provide a total dry film thickness of 90 mils.

3.04 INSPECTION

- A. The wet film thickness of each coat shall be checked during application by averaging numerous measurements taken with a film gage and thickness shall be sufficient that when cured the dry film thickness will be as specified herein.

- B. Surfaces coated shall be visibly checked to insure areas have not been missed and all holidays in the film are repaired.
- C. Coating Work shall be subject to inspection at any time to insure compliance with the manufacturer's recommendations. Test areas shall be cut whenever requested by the manufacturer's technical representative to verify conformance to the Specifications. Unsatisfactory area shall be remedied by the applicator.

3.05 PROTECTION COURSE

- A. Install protection mat on cured membrane after testing, without delay, so that the period of exposure shall be minimized.
- B. Install drainage board over protection mat.

3.06 PROTECTION

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

3.07 CLEAN UP

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

END OF SECTION

SECTION 07 2600

VAPOR BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Vapor barrier and accessories for installation under concrete slabs.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 3000: Cast-in-Place Concrete.
3. Division 09: Finishes; flooring sections.

1.02 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

B. ASTM International (ASTM):

1. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
2. ASTM D1709 - Standard Test Methods of Impact Resistance of Plastic Film by the Free-Falling Dart Method.
3. ASTM E154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs.
4. ASTM E1643 - Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
5. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.03 SUBMITTALS

- ###### A. Product Data: Submit manufacturer's product data and installation instructions for vapor barrier and accessories.

- B. Samples:
 - 1. 12 inch by 12 inch vapor barrier samples.
 - 2. Pressure-Sensitive Tape: 12 inch long sample.
- C. Test Reports: Conducted by nationally recognized independent testing agency indicating conformance with specified performance requirements.

1.04 QUALITY ASSURANCE

- A. ASTM tests referenced in this Section shall be performed on a single production roll per ASTM E1745 Section 8.1. Submit third party documentation certifying this requirement.
- B. Pre-Installation Conference: CONTRACTOR shall coordinate and conduct pre-installation conference in accordance to Section 01 3119, Project Meetings, to review the progress of construction activities and preparations for the installation of vapor barrier.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, handle and protect in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging with labels intact.
- C. Store materials in a clean and dry area.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Multi-layer plastic extrusion manufactured with high grade prime, virgin, polyolefin resins. Thickness shall be 15 mils minimum.
 - 1. Stego Wrap by Stego Industries LLC.
 - 2. Perminator by W.R. Meadows.
 - 3. Ecoshield-E by Epro.
 - 4. Husky Yellow Guard by Poly-America.
 - 5. Equal.
- B. Physical Properties:

1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 2. Class Rating per ASTM E1745: Class A.
 3. Puncture resistance per ASTM D1709: 2200 g or higher.
 4. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
- C. Accessories: Provide manufacturer recommended accessories for seams, penetrations and perimeter edges, including tapes, mastics, termination for a complete vapor barrier installation per ASTM E1643.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine subsoil and notify OAR of deficiencies detrimental to proper vapor barrier installation; do not proceed until corrected.

3.02 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643 and manufacturer's instructions.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise, where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself using manufacturer ASTM E1643 compliant accessory designed to adhere to concrete. Seam tape shall not be used for sealing the vapor barrier to the foundation wall, grade beam or slab.
 3. Overlap joints 6 inches and seal with manufacturer's seam tape.
 4. Seal vapor barrier penetrations per manufacturer's instructions.
 5. Avoid the use of non-permanent stakes driven through the vapor barrier.
- B. Prior to concrete placement inspect vapor barrier for damage. Clean damaged areas and with vapor barrier material cut a minimum 6 inches larger than damaged area on all sides. Seal to main vapor barrier with continuous seam tape.

3.03 CLEAN UP

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

3.04 PROTECTION

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

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior and exterior accessibility, identification, directional and informational signs.

B. Related Requirements:

1. Division 01: General Requirements.
2. Section 08 1113: Hollow Metal Doors, Windows and Frames.
3. Division 09: Finishes.

1.02 REFERENCES

A. ASTM International:

1. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM D4802 - Standard Specification for Poly (Methyl Methacrylate) Acrylic Plastic Sheet.

B. Codes:

1. ADA – Americans with Disability Act of 1990
 - a. ADA Standards – ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.
2. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC) Volumes 1 and 2022 Edition.

1.03 SUBMITTALS

- A. Product Data: Submit material descriptions, finishes and color charts for each type of sign.
- B. Shop Drawings: Submit Shop Drawings indicating sign style, lettering, overall dimensions and quantities. Submit floor plans showing locations for each sign.

- C. Material Samples: Submit three samples illustrating full size sample sign, of type, style and color specified.
- D. Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

- A. Pre-Installation Conference: Notify OAR when signs are ready for installation. Arrange for conference at site. Do not proceed with installation until ARCHITECT'S approval of specific locations and methods of attachment has been obtained.
- B. Provide signs from one manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site and protect from damage. Store until immediately prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products of following manufacturers are acceptable and are the basis for intended design and quality.
 - 1. H. Toji and Company.
 - 2. Karman Ltd., Architectural Signs.
 - 3. Vomar Products Inc.
 - 4. ASI-Modulex, Inc.
 - 5. Mohawk Sign Systems, Inc.
 - 6. Accent Signage Systems.
 - 7. The Gruenke Company.
 - 8. Ada Sign Products.
 - 9. AccuBraille.
 - 10. Equal.

2.02 MATERIALS AND FABRICATION

- A. Interior Sign Materials:

1. Substrate Panel: 1/8 inch minimum thick, integrally colored or clear acrylic plastic, or laminated acrylic. Conforming to ASTM D4802; non-glare (matte), UV stable, suitable for interior and exterior use.
 - a. Corners shall be square.
 - b. Edges shall be square and eased.
 - c. Colors as selected by ARCHITECT from manufacturer's custom color range.
2. Fasteners:
 - a. Stainless steel tamper-proof screws and plastic anchors.
 - b. Signs mounted on fire-rated doors shall be secured with adhesive.
 - c. Adhesives and sealants shall comply with the limits for VOC content and shall be approved by OWNER's Office of Environmental Health Services (OEHS).

B. Exterior Sign Materials:

1. Sign: ASTM B209 aluminum sheet, 0.080 inch thick with rounded corners of at least 1/8 inch radius and eased edges. White figure on a blue background; non-glare, high contrast signs. The blue shall be equal to color number 15090 in Federal Standard 595C.
2. Fasteners: Stainless steel carriage bolts with tamper resistant nuts.

C. Characters and Symbols: Shall be fabricated by one of the processes described below:

1. Computer cut raised characters and graphics shall be cut from 1/16 inch integrally colored acrylic. Raised characters and graphics shall be inlaid 1/32 inch minimum into first surface of sign background, secured with adhesive so it cannot be removed without the use of tools. Raised characters and graphics shall have beveled, eased or rounded edges. Non-tactile text and graphics shall be applied to the second surface, and background color shall be applied to the second surface and protected with film or an additional backplate. Pictograms and other symbols including the International Symbol of Accessibility, which are included on signs with raised characters and Braille, are not required to be raised.
2. Raised characters and graphics including braille shall be integral to sign face and shall be formed into sign face by high pressure thermoforming using a negative mold. No applied, glued, welded tactile elements are acceptable. Raised characters and graphics shall have beveled, eased or rounded edges. No sharp, square edges are acceptable. Non-tactile text and graphics shall be applied to the second surface, and background color shall be applied to the second surface and protected with vinyl film. Pictograms and other symbols including the International Symbol of Accessibility, which are included on signs with raised characters and Braille, or other signs are not required to be raised.

- A. Raised Characters Raised characters shall comply with CBC 11B-703.2.
1. Character Type: Characters on signs shall be raised 1/32 inch minimum above their background and shall be sans serif uppercase characters duplicated in Braille. Characters and Braille shall be in a horizontal format.
 2. Character Height: Character height measured vertically from the baseline of the character shall be 5/8 inch minimum and 2 inch maximum based on the height of the uppercase letter "I".
 3. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the letter "I".
 4. Stroke Thickness: Stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character.
 5. Character and Line Spacing shall be in conformance to CBC 11B-703.2.7 and 11B-703.2.8.
 6. Character Placement: Shall be placed in accordance to Paragraph 2.03, C below.
- B. Visual Characters: Visual characters shall comply with CBC Section 11B-703.5. Characters shall be conventional in form, and shall be uppercase or lowercase or a combination of both, as indicated on the drawings. Characters shall not be italic, oblique, highly decorative, or of other unusual forms.
1. Finish and Contrast: Characters and their backgrounds shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or a dark characters on a light background.
 2. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase of the letter "I".
 3. Character Height: Minimum character height shall comply with CBC Table 11B-703.5.5.
 4. Height from Finish Floor or Ground: Visual characters shall be a 40 inches minimum above the finish floor or ground
 5. Stroke Thickness: Uppercase letter "I" shall be 10 percent minimum and 20 percent maximum of the height of the character.
 6. Character and Line Spacing: Shall be in accordance to CBC 11B-703.5.8 and 11B-703.5.9.
- C. Braille: Contracted Grade 2 Braille, conforming to CBC 11B-703.3. Braille characters shall be inlaid optically correct acrylic Raster beads into computer drilled holes in the panel surface.

1. Dimensions and Capitalization: Braille dots shall have a domed or rounded shape and shall comply with CBC Table 11B-703.3.1. The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.
 2. Position: Braille shall be positioned below the corresponding text in a horizontal format, flush left or centered. If text is multi-lined, Braille shall be placed below the entire line of text. Braille shall be separated 3/8 inch minimum and 1/2 maximum from any other tactile characters and 3/8 inch minimum from raised borders and decorative elements.
- D. Pictograms: In conformance to CBC 11B-703.6. Pictograms shall have a field height of 6 inches minimum. Characters and Braille shall not be located in the pictogram field.
1. Finish and Contrast: Pictograms and their field shall have a non-glare finish. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field.
 2. Text Descriptors: Pictograms shall have text descriptors located directly below the pictogram field, and shall comply with CBC 11B-703.2, 11B-703.3 and 11B-703.4.
- E. International Symbol of Accessibility (ISA): Shall comply with CBC 11B-703.7 and CBC Figure 11B-703.7.2.1. The ISA shall consist of a white figure on a blue background. The blue color shall be approximate to FS. 15090 in Federal Standard 595C.
- F. Mounting Locations and Height: Signs with tactile characters shall be as indicated on the drawings and in conformance to CBC 11B-703.4.
1. Mounting Locations:
 - a. Identification signs for rooms and spaces shall be located on the wall adjacent to the latch side of the door, as one enters the room or space.
 - b. Signs that identify exits shall be located at the exit door when approached in the direction of egress travel.
 - c. Signs containing tactile characters shall be located so that a clear floor space 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
 - d. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side.
 - e. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located at the inactive leaf.
 - f. Where a tactile sign is provided at double doors with two active leaves, the sign shall be located to the right of the right hand door.

- g. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall.
- 2. Mounting height above finish floor or ground: Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest Braille cells and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the highest line of raised characters.

2.04 ROOM IDENTIFICATION SIGNS

A. Room Identification Sign Types:

- 1. Room Identification Sign with Changeable Insert: 7 inches high by 9 inches wide, minimum, with 4 inches high by 9 inches wide window for name and title removable insert. Locate room name immediately below window, and centered above room number. Room name shall be raised characters 3/4 inches high minimum, and room number 1 inch minimum; and shall be accompanied with Braille indicators.
- 2. Room Identification Sign with Room Name and Room Number: 7 inches high by 9 inches wide, minimum. Room name shall be raised characters 3/4 inches high minimum, and room number 1 inch minimum; and shall be accompanied with Braille indicators.
- 3. Room Number Sign: 7 inches wide by 4 inches high; room number, 1 inch high minimum, raised character, accompanied by Braille indicator immediately below.

B. Room Identification Sign Requirements:

- 1. Finish and Contrast: Refer to paragraph 2.03.B.
- 2. Raised Characters and Proportions: Refer to paragraph 2.03.A.
- 3. Braille: Refer to paragraph 2.03.C.
- 4. Mounting Location and Height: Refer to paragraph 2.03.F.

2.05 RESTROOM SIGNAGE

A. Multiple-Occupancy restrooms shall be provided with geometric symbols and wall mounted pictograms with text descriptors.

B. Geometric Symbols:

- 1. Doorways leading to toilet rooms shall be identified by a geometric symbol complying with CBC Section 11B-703.7.2.6.
- 2. Male Restroom Door Symbol: 1/4 inch thick equilateral triangle with edges 12 inches long, with vertex pointing upward, the triangle symbol shall contrast

with the door, either light on a dark background or dark on a light background. A male silhouette shall appear within the equilateral triangle in contrasting color to it.

3. Female Restroom Door Sign: 1/4 inch thick circle 12-inch diameter, the circle symbol shall contrast with the door, either light on a dark background or dark on a light background. A female silhouette shall appear within the circle in contrasting color to it.
 4. “All Gender” Restroom Door Sign (Single occupancy restrooms): 1/4 inch thick circle, 12-inch diameter with a 1/4 inch thick equilateral triangle with the vertex pointing upward superimposed on the circle and within the 12-inch diameter. Triangle and circle shall be of contrasting colors; the circle symbol shall contrast with the door. A female and male silhouettes shall appear within the equilateral triangle in contrasting color to it.
 5. Edges and Vertices on Geometric Symbols: Shall be eased or rounded at 1/16 inch minimum, or chamfered at 1/8 inch maximum. Vertices shall be radiused between 1/8 inch minimum and 1/4 inch maximum.
 6. Location and Mounting Height: Symbols shall be mounted at 58 inches minimum and 60 inches maximum above the finish floor or ground surface measured from the centerline of the symbol. Where a door is provided the symbol shall be mounted within one inch of the vertical centerline of the door.
- C. Room Identification for Multiple-Occupancy Restrooms: Provide a 16 inch long by 6 inch tall room identification sign, including a pictogram of the International Symbol of Accessibility on a side. Restroom names shall be “Girls” or “Boys”, for students, and “Women” and “Men” for staff. Characters, Braille, pictograms and mounting locations and height shall be in conformance to Article 2.03.
- D. Room Identification for Single-Occupancy Restrooms: Provide a 16 inch long by 6 inch tall room identification sign, including a pictogram of the International Symbol of Accessibility on a side. Text descriptor shall be “All Gender Restroom”. Characters, Braille, pictograms and mounting locations and height shall be in conformance to Article 2.03.

2.06 RAISED CHARACTER AND BRAILLE EXIT SIGNS

- A. Tactile Exit Sign Types:
1. “EXIT”.
 2. “EXIT STAIR DOWN”.
 3. “EXIT RAMP DOWN”.
 4. “EXIT STAIR UP”.
 5. “EXIT RAMP UP”.
 6. “EXIT ROUTE”.

7. "TO EXIT".
8. "EXIT WITH ALARM", on exit doors with an alarm.
9. "EXIT ONLY" or "EXIT STAIR ONLY", on exit doors and stair exit doors which lock from outside and does not allow a return.

B. Sign Requirements:

1. Finish and Contrast: Refer to paragraph 2.03.B.
2. Raised Characters and Proportions: Refer to paragraph 2.03.A.
3. Braille: Refer to paragraph 2.03.C.
4. Mounting Location and Height: Refer to paragraph 2.03.F.

2.07 DIRECTIONAL EXIT SIGNAGE

- A. At exits serving a required accessible space but not providing an approved accessible means of egress, at elevator landings and within areas of refuge, provide signage indicating the location of accessible means of egress.
1. Finish and Contrast: Refer to paragraph 2.03.B.
 2. Character Height and Proportions: Refer to paragraph 2.03.B.
 3. Symbol of Accessibility: Refer to paragraph 2.03.E.

2.08 ACCESSIBILITY ENTRANCE SIGNS AND PATH OF TRAVEL DIRECTIONAL SIGNS

- A. Entrance Sign: Provide at each building entrance an International Symbol of Accessibility sign. Signs shall be visible to persons along approaching pedestrian ways.
- B. Directional Signs: Provide where indicated on the drawings with arrow indicators and International Symbol of Accessibility.
- C. Signs shall be mounted on wall with lower edge between 48 inches and 60 inches above ground surface or finish floor. Pole mounted, overhead and projecting signs shall have the lower edge at least 80 inches from the ground surface or finish floor.
- D. Sign shall comply with the following requirements.
1. Directional Signs: Refer to paragraph 2.03.B.
 2. Symbol of Accessibility: Refer to paragraph 2.03.E.
- E. No Smoking Sign: Provide at each building entrance. Reverse cut white vinyl sign with 4 1/2-inch high no smoking symbol, mounted on glass entry doors. Under No Smoking symbol, place words "No Smoking", 1/2 inch high minimum, San Serif upper and lower case characters.

2.09 PARKING SIGNS

- A. Tow-Away Sign: 18 inches by 24 inches with rounded corners. Black graphics on white background, with lettering not less than 1 inch high. Sign to read: “UNAUTHORIZED VEHICLES PARKED IN DESIGNATED ACCESSIBLE SPACES NOT DISPLAYING DISTINGUISHING PLACARDS OR SPECIAL LICENSE PLATES ISSUED FOR PERSONS WITH DISABILITIES WILL BE TOWED AWAY AT THE OWNER’S EXPENSE. TOWED VEHICLES MAY BE RECLAIMED AT LASPD – 125 N. BEAUDRY AVE., OR BY TELEPHONING (213) 742-8231”.
- B. Parking Space Identification Sign: 12-inch by 18-inch with rounded corners. White reflectorized graphic on dark blue background, and shall display an 8-inch high International Symbol of Accessibility per paragraph 2.03.E.
 - 1. Additional language or an additional sign below the International Symbol of Accessibility shall state I “Minimum Fine \$250”.
 - 2. Signs identifying van accessible parking spaces shall contain additional language or an additional sign with the designation “Van Accessible”.
- C. Signs shall be mounted on posts at head of each accessible parking with lower edge 80 inches minimum above ground surface, or mounted on walls at a minimum height of 60 inches from ground surface.
- D. Headroom Signs: On parking structures provide signs indicating headroom clearance height at entries and at any point of a vehicular path where entry clearance height is reduced. Minimum character height shall be 3 inches.

A.

2.10 EMERGENCY GAS SHUT OFF SIGN

- A. Exterior Signs: Painted aluminum, suitable for outdoor use, with pre-drilled mounting holes.
 - 1. Sign Size: Minimum 4 inches high by 8 inches wide.
 - 2. Color: Subsurface white text, red background.
 - 3. Character Height: One inch high.
 - 4. Text:
 - a. Site main gas shut off valve(s): “MAIN SITE EMERGENCY GAS SHUT-OFF VALVE”.
 - b. Building gas shut-off valve(s): “BUILDING EMERGENCY GAS SHUT-OFF VALVE.”

2.11 LADDER TO ROOF SIGN

- A. 1/8 inch thick acrylic.

1. Sign Size: Minimum 4 inches high by 8 inches wide.
2. Color: Subsurface white text, red background.
3. Character Height: One inch high.
4. Text: "LADDER TO ROOF".

2.12 FIRE SPRINKLER RISER ROOM SIGN

- A. Locate one sign at each fire sprinkler riser room door as indicated in drawings.
- B. Text: Sign to read "Fire Sprinkler Riser Inside", white characters, 1 inch high on red background.
- C. Sign Requirements:
 1. Raised Characters and Proportions: Refer to paragraph 2.03.B.
 2. Braille: Refer to paragraph 2.03.C.
 3. Mounting Location and Height: Mounted on the door, refer to paragraph 2.03.F.

2.13 ELEVATOR SIGNS

- A. Emergency Signs: Pictorial sign shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevator in case of fire. Sign shall read: "IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS." Letters shall be not less than 1/2 inch, on a contrasting background.
- B. Floor numbers: Elevator hoistway shall have a floor number not less than 4 inches in height, placed on the walls and/or doors of the hoistway at intervals such that a person in a stalled elevator, upon opening the car door, can determine the floor position.
- C. Machine Room: A sign shall be permanently displayed in the elevator machine room, elevator machinery space, elevator control space, or elevator control room in a conspicuous location with a minimum 1-1/2 inch letters on a contrasting background, stating:

NO COMBUSTIBLE STORAGE
PERMITTED IN THIS ROOM
By Order of the Fire Marshal [or name of fire authority]

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts condition of existing surfaces.

3.02 METHODS OF INSTALLATION

A. Interior Identification Signs and Interior Directional Signs:

1. Fasten to wall with four tamper-proof round-head screws, one at each corner of sign. Furnish plastic anchors.
2. When concealed installation is specified, install backplate to wall as above. Fasten sign to backplate with very high-bond double-faced tape.
3. For installation on glass, fasten sign to glass with very high bond double faced tape. On opposite side of glass, anchor matching backplate to glass with very high-bond double-faced tape.

B. Geometric Signs: Geometric toilet room signs shall be fastened to doors with three tamper-proof oval-head counter-sunk screws.

C. Exterior Wall Mounted Identification Signs and Directional Signs:

1. Aluminum signs: Fasten to wall with 4 tamper-proof round-head screws, one at each corner of sign. Furnish plastic anchors.
 - a. Cement Plaster, Brick, or Masonry: Provide plastic anchors. For signs greater than 640 square inches use Leadwood Screw Anchors, concrete fasteners 1WSA 10112, or equal.
 - b. Chain Link Fence: Fasten with 9 gage hog rings, King Hughes Fasteners 5150DG50, or equal, with 11/16 inch opening at each corner of sign.
 - c. Wrought Iron Fence: Install at each corner with 3/16 inch stainless steel rivets.
2. Acrylic signs: Install backplate to wall as indicated above. Fasten sign to backplate with high-bond double-faced tape and silicone.

3.03 INSPECTION

- #### A. Tactile signs shall be field inspected for compliance after installation (CBC 11B-703.1.1.2)

3.04 CLEANUP

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

3.05 PROTECTION

- #### A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 220000

GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The General conditions, supplementary conditions, special Requirements, and applicable portions of Division 1 of the specification are a part of this Division and the requirements contained herein are supplementary to them.
- B. This Division is an integrated whole comprising interrelated and interdependent sections and shall be considered in its entirety in determining requirements.
- C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

1.2 ABBREVIATIONS AND DEFINITIONS (as used on Division 23 Drawings and herein)

- A. This Division is abbreviated and includes incomplete sentences. Supply omitted words by inference.
- B. Symbols: "S" means submittals are required; "M/O" means Maintenance/Operating data is required; see paragraphs hereinafter.
- C. "Provide" means furnish, install and connect unless otherwise described in specific instances.
- D. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.
- E. "Extend", "Submit", "Repair", "Abandon", "Replace", "Remove" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.
- F. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constructed authorities and public utility franchise holders having jurisdiction.
- G. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- H. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces which are not included in the utility areas definition.

- I. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- J. "Below Grade" means buried in the ground, unless noted otherwise.
- K. "Substantial Plumbing Completion" means all components of all systems are functioning but lacking in final adjustment.
- L. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid which the device will serve.

1.3 DESCRIPTION

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

1.4 RELATED WORK

- A. Coordination: Refer to Architectural, Civil, Structural, Mechanical and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of plumbing work in relation to the work of other Divisions.
- B. Examine other Divisions for work related to the work of this Division especially Division 23 – MECHANICAL and Division 26 - ELECTRICAL.

1.5 EXISTING CONDITIONS

- A. Visit the site prior to bidding and investigate the existing conditions which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.
- B. The location of existing concealed utility lines are shown in accordance with reference data received by the Architect. The Architect does not guarantee the accuracy of such data. The points of connection are therefore approximate and the Bidder shall include adequate funds in his bid to cover costs of connection regardless of their exact location.
- C. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to existing utility lines at no cost to the Owner, whether the lines are shown on drawings or not.

1.6 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or the specifications, request clarification.
- B. The Architect shall interpret the drawings and the specifications, and his decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusive.
- C. In case of conflict not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.
- D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

1.7 WATER (DOMESTIC), SANITARY SEWERS SERVICE

- A. Within 5 days after award of contract, notify the serving utilities that the project is under construction and apply for permanent service in the name of the Owner. Furnish pertinent load and location information to them including the required dates for permanent service. Verify service locations and conform to utility company requirements. Contractor shall pay charges for permanent service connections levied by the utilities for which he will be reimbursed by the Owner. The reimbursement shall be limited to the actual amount of the utility service charges and a copy of the billing from the utility company shall accompany the Contractor's invoice.

1.8 PERMITS AND INSPECTIONS

- A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.9 CODES AND REGULATIONS

- A. By submitting a bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract documents and the Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specify references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him

permission to use options which are permitted by Codes.

- B. Applicable Codes: (Current editions unless otherwise noted)
 - 1. All local codes; city and/or County as applicable
 - 2. OSHA requirements
 - 3. California Building Code
 - 4. California Mechanical Code
 - 5. California Plumbing Code
 - 6. California Code of Regulations (CCR) Titles
 - 7. Fire Marshal Regulations
 - 8. Regulations of all other authorities having jurisdiction.
- C. Where conflict or variation exists among codes, the most stringent shall govern.
- D. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.
- E. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- F. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- G. Permits and Certificates of Inspection: Furnish the originals.
- H. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- I. Other data required by other sections of this Division. Furnish 2 copies.

1.10 RECORD AND DOCUMENTATION

- A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work:
 - 1. Record (As-Built) Drawings:
 - a. Maintain in good order in the field office a complete set of prints for all work being done under Division 23. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
 - b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub-outs shall be accurately located and dimensioned from building walls or other permanent landmarks.
 - c. Furnish the originals.
 - 2. Operation and Maintenance Manual: Furnish an operation and maintenance

manual covering the stipulated plumbing systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent, shall be provided to the Architect in accordance with the Division 1 section on Maintenance and Operation Manuals. Furnish one complete manual prior to the time that system or equipment tests are performed. Furnish the remaining manuals before the contract is completed. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL

PROJECT TITLE.....

CONTRACTOR.....

Provide a table of contents. Insert tab sheets to identify discrete subjects. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:

- a. Updated approved materials list, shop drawings and catalog information of all items indicated by symbol "M/O" at titles or beginning of paragraphs.
- b. System layout showing piping, valves and controls.
- c. Wiring and control diagrams with data to explain detailed operation and control of each component.
- d. A control sequence describing start-up, operation and shutdown.
- e. Detailed description of the function of each principal component of the system.
- f. Procedure for starting.
- g. Procedure for operation.
- h. Shut-down instruction.
- i. Installation instructions.
- j. Adjustments, maintenance and overhaul instructions.
- k. Lubrication schedule including type, grade, temperature range and frequency.
- l. Safety precautions, diagrams and illustrations.
- m. Test procedures.
- n. Performance data.
- o. Parts lists, with manufacturer's names and catalog numbers.
- p. Preventive maintenance schedule.
- q. Service organization with name, address and telephone number.
- r. Valve identification chart and schedule.
- s. ASME certification

- B. Standard Compliance: Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards (ANSI), American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), Underwriters Laboratories (UL), American Refrigeration Institute (ARI), American Gas Association (AGA), or National

Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.

- C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.
- D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- E. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- F. Permits and Certificates of Inspection: Furnish the originals.
- G. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- H. Other data required by other sections of this Division. Furnish 2 copies.

1.11 TOOLS

- A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- B. Whenever on the plans, or in these specifications, products are identified by the name of one

manufacturer, it is intended that equivalent products of other manufacturers are acceptable, unless otherwise indicated, if accepted as a substitution by the Architect. Where three or more manufacturers are listed as "acceptable manufacturers" however, then the products furnished shall be the product of one of the manufacturers listed. Manufacturers listed as "acceptable manufacturers" shall meet quality and performance of a particular one specified by both name and catalog number.

2.2 SUBSTITUTIONS

- A. General: Should the Contractor desire to substitute for specified products, he shall submit with the Material List a complete list of the requested substitutions. The request shall contain complete descriptive information of the products. Samples for evaluation shall also be submitted upon the Architect's request. If in the Architect's opinion the products as presented in this first submittal are in variance with the specified products, or if the information submitted is not sufficiently complete to allow proper evaluation, the substitution will be disallowed from consideration and the specified products shall be furnished. By proposing a substitution, it is deemed that the Contractor shall bear the cost of any changes (whether architectural, structural, electrical or mechanical) necessary to accommodate the substitution.
- B. Specific: Refer to other sections of this Division for additional requirements.

2.3 SUBMITTALS

- A. General:
 - 1. Provide for all items indicated with the symbol "S" at titles or beginning of paragraphs in accordance with the Division 1 section covering submittals and as herein specified. Where warranty of longer than one year is specified, include such warranty with submittal. Architect's review of the submittal is only for general conformance with design compliance with the information given in the contract documents. The submittal procedure is required as an effort to minimize the problems which occur due to the discovery of Contractor non-compliance at the construction site. The Contractor is responsible for conformation and correlation of the dimensions, quantities and sizes, for information that pertains to fabrication methods or construction techniques, and for coordination of work of all Divisions of the work. Deviations, if any, from Contract documents shall be clearly and completely indicated (by a separate letter if deviations are extensive) in the submittals, and the lack of such is deemed complete compliance with Contract Documents without any deviations. Submittals favorably processed will not relieve the Contractor of responsibility for deviations not so reported nor for errors in the submittal.
 - 2. In addition to the above, upon permission to proceed after review of submittal and prior to the installation of work, submit dimensioned and scaled drawings (not less than 1/4-inch equal to one foot) of all mechanical equipment rooms and areas. Such layouts shall indicate, but not be limited to, all plumbing equipment, control panels, piping, housekeeping pads, ductwork, tube pull, access and maintenance clearances, and other like items. The layout shall also indicate major equipment to be provided under other Sections of work.

3. Contractor Stamp: All submittals shall be stamped with the following text and signed by the Contractors representative:

"IT IS HEREBY CERTIFIED THAT THE PRODUCTS SHOWN AND MARKED IN THIS SUBMITTAL ARE IN COMPLIANCE WITH THE CONTRACT DOCUMENTS AND CAN BE INSTALLED IN THE ALLOCATED SPACES EXCEPT WHERE NOTED AS DEVIATIONS.

CERTIFIED BY:----- DATE:-----

4. All submittals shall be complete and with catalog data and information properly marked to show, among other things, equality of material (where substitution is allowed and desired), adequacy in capacity and performance to meet minimum capacities of performance as specified or indicated. Arrange the submittals in the same sequence as these specifications, and reference (at the upper right-hand corner) the particular specification provision for which each submittal is intended. Incomplete submittals will be rejected.
 5. For all work under Division 23, the notations by the Contractor or Supplier on submittal documents "Per Plans and Specifications", or "As Specified", or similar wording or phrasing is not acceptable and will be cause of rejection. Complete descriptive submittals are required for all Division 23 work.
 6. Refer to the other sections of this Division for specific requirements.
- B. Material List: Within 15 days after award of Contract, submit for approval a complete list of materials proposed for use. Furnish names and addresses of manufacturers, catalog numbers (where applicable) types and trade names. For purposes of uniformity, only one manufacturer will be accepted for each class or type of material. This list is in addition to Shop Drawings.
- C. Shop Drawings: Submit shop drawings with such promptness as to cause no delay in the work. Do not commence fabrication of the equipment until the approved drawings are received from the Owner's representative.
- D. Other Submittals: As required by other sections of this Division.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION METHODS

- A. Workmanship shall be in the best standard practice of the trade.
- B. Execute the work so as to contribute to ease of operation and maintenance, maximum accessibility and best appearance. Execute it so that the installation will conform and adjust itself to the building structure, its equipment and its usage. The work shall be symmetrical, plumb, uniform, properly aligned, and firmly secured in place.
- C. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.2 TESTS

- A. General:
 - 1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
 - 2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- B. Specific: Refer to the other sections of this Division for test requirements.

3.3 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

- A. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.
- C. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings, and shop fabricated ductwork.
- D. Keep cabinets and other openings closed to prevent entry of foreign matter.

3.4 CLEANUP AND HOUSEKEEPING

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Leave exposed parts of the plumbing work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.

3.5 PROJECT CONDITIONS

- A. Site Examinations and Conditions:
 - 1. Regard information relative to existing conditions, services and structure as approximate only. Verify dimensions and locations, and be knowledgeable of all working conditions before submitting Bid. Verify pressure, location, size, and elevation of existing services (to which points of connection are to be made or crossed) as soon as possible and prior to commencement of any new work.
 - 2. Make minor deviations necessary to conform to actual locations and conditions. Submission of Bid presumes proper examination of Site, locations, dimensions and conditions, and no additional cost will be honored for lack of such examinations.
- B. Existing Services: Examine the Contract Drawings and visit the project site to ascertain the extent of the existing services. Where existing equipment/services serving existing structures and/or existing structures to be demolished are to remain in service, reroute, relocate, or extend such existing equipment and/or services to accommodate this project without additional cost.

- C. **Interruption of Existing Services:** Where it is necessary to reroute existing services or utilities, or to make connections of new work to existing services or utilities, give timely written notice of such intent to the Owner and secure written approval before proceeding. Make all such interruptions at such time as permitted by the Owner. Anticipate such interruptions to be made outside of normal working hours or normal working days; therefore, no additional cost will be permitted for such work. Except in a case of emergency involving life, limb or health, do not operate any existing equipment (including valves). Where such operations are necessary, they shall be performed by the Owner's personnel.
- D. **Access and Placement of Work:**
1. Check and coordinate for clearance, accessibility and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped, disassembled, or disassembly of equipment at Project Site and re-assembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.
 2. Verify location of all plumbing fixtures and equipment within finished spaces with the Architectural Drawings. In the event that Plumbing Drawings do not indicate exact locations, or are in conflict with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.
- E. **Verification and Coordination:** Drawings indicating suggested distribution routes are diagrammatic only, and all scaled and figured dimensions are approximate and are indicated for estimating purposes only. The Drawings do not indicate necessary offsets and like items. Do not construe Contract Drawings as fabrication drawings. Prior to fabrication and installation of work, verify all dimensions, sizes and distribution routes with actual conditions, and prepare submittal and fabrication drawings. Coordinate to avoid possible conflicts and resolve same where such exist. Install work to conform to structure, avoid obstruction, preserve headroom, and keep openings and passageway clear. Changes necessary, resulting from such verification and coordination, shall not be a cause for additional cost.
- F. See Drawings for extent of demolition.

3.6 WARRANTY

- A. Guarantee, in writing, all work against fault of any product or workmanship for a period of not less than one year after formal acceptance by the Owner; except, where longer periods are specified in the Specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components that are inactive because of said failure shall be suspended. The warranty period for such component shall resume running for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.

- B. Neither payments for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence of omission of Contractor in doing the work.

3.7 SAFETY REQUIREMENTS

- A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts in accordance with the OSHA 1910.219. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

3.8 MANUFACTURER'S RECOMMENDATIONS

- A. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material or equipment being installed, furnish printed copies of these recommendations to the installing Contractor and Architect prior to installation. Do not proceed with the installation of the item until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

END OF SECTION 220000

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Specialty valves.
 - 3. Flexible connectors.
 - 4. Water meters furnished by utility company for installation by Contractor.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
 - 1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 2. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 3.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, drawn temper.
 - 1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 2. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Description:
 - a. Pressure Rating: 250 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 300 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Description:
 - a. Non conducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Description:
 - a. Electroplated steel nipple.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.6 FLEXIBLE CONNECTORS

- A. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum 250 psig.
 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 32 Section "Sitework Concrete" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

- D. Install shutoff valve, hose-end drain valve, strainer, and test tee with valve, inside the building at each domestic water service entrance. Comply with Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for pressure-reducing valves.
- G. Install domestic water piping level without pitch and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping adjacent to equipment and specialties to allow service and maintenance.
- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition unions.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 Use dielectric nipples.
- D. Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.

- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.11 CLEANING

- A. Clean and disinfect potable water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- D. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L cast-copper solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS (ABOVE GROUND)

- A. Pipe and Fittings: ASTM A 888 or CISPI 301. All cast iron soil piping shall be of domestic manufacture.
- B. CISPI, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Dallas Specialty & Mfg. Co.
 - c. Fernco Inc.
 - d. Matco-Norca, Inc.
 - e. MIFAB, Inc.
 - f. Stant.
 - g. Tyler Pipe.
 - 2. Standards: ASTM C 1277 and CISPI 310.
 - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Dallas Specialty & Mfg. Co.
 - d. MIFAB, Inc.
 - e. Mission Rubber Company; a division of MCP Industries, Inc.
 - f. Stant.
 - 2. Standards: ASTM C 1277 and ASTM C 1540.
 - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 ABS PIPE AND FITTINGS (BELOW GROUND)

- A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

- C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- D. Solvent Cement: ASTM D 2235.
 - 1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
 - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Mission Rubber Company; a division of MCP Industries, Inc.

- 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
- b. Standard: ASTM C 1173.
- c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- 4. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company; a division of MCP Industries, Inc.
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used

on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- L. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- M. Install aboveground ABS piping according to ASTM D 2661.
- N. Install underground ABS piping according to ASTM D 2321.
- O. Plumbing Specialties:
 - 1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.

- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Install hangers for ABS piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
- J. Install supports for vertical ABS piping every 48 inches.
- K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes

before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, vent piping NPS 4 and smaller shall be the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
 1. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.

END OF SECTION 221316

SECTION 260501

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the general requirements for Division 26 - Electrical.
 - 1. Division 1 and the General Conditions apply to all work of this section.
 - 2. Division 26 supplements the applicable requirements of other Divisions.
- B. The Work includes 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 division, complete, as shown on the drawings and/or specified herein.
 - 1. Examine all divisions for related work required to be included as work under this division.
- C. Owner-furnished items: Pick up Owner-furnished items and handle, deliver, install, and make all final connections.
 - 1. Assume responsibility for the items when consigned at the storage facility in accord with requirements of the Contract Documents.

1.02 REFERENCES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.
- B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:
 - 1. ANSI American National Standards Institute
 - 2. ASTM American Society for Testing and Materials
 - 3. IEEE Institute of Electrical and Electronics Engineers
 - 4. NEC National Electrical Code (NFPA 70)
 - 5. NEMA National Electrical Manufacturers Association
 - 6. NFPA National Fire Protection Association
 - 7. UL Underwriters Laboratories, Inc.

1.03 QUALITY ASSURANCE

- A. Regulation: All the electrical equipment and materials, including their installation, shall conform to the following latest applicable codes and standards:
 - 1. California Electrical Code (CEC).
 - 2. California State Fire Marshal.
 - 3. Occupational Safety and Health Act (OSHA).
 - 4. Requirements of Serving Utility Companies.
 - 5. Local Codes and Ordinances.
 - 6. Requirements of the California Division of the State (DSA).
 - 7. California Administrative Code, Title 8, Chapter 4, Industrial Safety Orders.
 - 8. California Administrative Code, Title 24.
 - 9. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply.
- B. Contractor's Expense: Obtain and pay for all required bonds, insurance, licenses, and pay for all taxes, fees and utility charges required for the electrical work.

1.04 SUBMITTALS

- A. Submit all of the items described in Paragraphs 1, 2, and 3 (below) as a single submittal. Partial submittals will not be accepted. Contractor shall review submittals for conformance with Contract Documents and make necessary revisions. Contractor shall also verify dimensions of equipment and be satisfied as to fit and that they comply with all code requirements relating to adequacy and clear working space. Submit the following in accordance with Division 1, with the additional electrical systems-related document requirements in electronic pdf copy format as specified below:
 - 1. Detailed shop drawings and associated product data/material lists (also see applicable technical specification sections following for additional requirements), for:
 - a. Switchgear/Switchboards (600V and Medium Voltage)
 - b. Substations
 - c. Panelboards
 - d. Engine generator systems
 - e. Motor control centers
 - f. Lighting control equipment
 - g. Fire alarm system
 - h. Public address/Intercom systems
 - i. Audio Visual and Sound Systems
 - j. Security Systems (including intrusion detection, access control and closed circuit television (CCTV))
 - k. LAN/Data systems including all equipment, cabling and distribution.
 - 2. Contractor shall submit shop drawings sealed by a Structural Engineer registered in the State of California to demonstrate compliance with the following:

a. Component Anchorage Requirements:

- 1) All mechanical, plumbing, and electrical components shall be anchored and installed per the details on the DSA approved construction documents. Where no detail is indicated, the following components shall be anchored or braced to meet the force and displacement requirements prescribed in the 2022 CBC. Sections 1616A.1.18 through 1616A.1.26 and ASCE 7-16 Chapter 13, 26 and 30:
 - a) All permanent equipment and components.
 - b) Temporary or movable equipment that is permanently attached (e.g. hard wired) to the building utility services such as electricity, gas or water shall include electrical connections except plugs for 110.220 volt receptacles having flexible cable.
 - c) Temporary, movable or movable equipment which is heavier than 400 pounds or has a center mass located 4 feet or more above the adjacent floor or roof level that directly support the components is required to be restrained in a manner approved by DSA.
- 2) The following mechanical and electrical components shall be positively attached to the structure but need not demonstrate design compliance with the references noted above. These components shall have flexible connections provided between the component and the associated ductwork, piping and conduit flexible connections must allow movement in both transverse and longitudinal directions.
 - a) Components weighing less than 400 pounds and have a center of mass located 4 feet or less above the adjacent floor or roof level that directly support the component.
 - b) Components weighing less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.

b. Piping, Ductwork, and Electrical Distribution System Bracing requirements:

- 1) Piping, ductwork, and electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7 Section 13.3 as defined in ASCE 7 Section 13.6.5, 13.6.6, 13.6.7 and 13.6.8; and 2022 CBC, Section 1617A.1.24, 1617A.1.25 and 1617A.1.26.
- 2) The method of showing bracing and attachments to the structure of the identified distribution system are as noted below. The MEP design

professional engineer responsible for content on these sheets has verified that the design methods identified below are in accordance with DSA IR 16-13.

- 3) Mechanical piping (MP), mechanical ducts (MD), plumbing piping (PP), electrical distribution systems (E):
 - 4) Option 1: Project-Specific Design
 - 5) Option 2: Design based on OSHPD OPM, within project submittal
 - 6) Option 3: Design based on OSHPD OPM, deferred submittal.
3. Product data/material lists (also see applicable technical specification sections following for additional requirements), in electronic pdf format, for:
- a. Raceways
 - b. Cable trays
 - c. Underground duct and fittings
 - d. Precast concrete pullboxes
 - e. Building wire and cable
 - f. Medium voltage cable
 - g. Cabinets, boxes and fittings
 - h. Wiring devices
 - i. Grounding components
 - j. Supporting devices
 - k. Nameplates and identification markers/labels
 - l. Enclosed circuit breakers
 - m. Overcurrent protective devices
 - n. Enclosed switches
 - o. Enclosed transfer switches
 - p. Enclosed motor controllers
 - q. Transformers
 - r. Lighting fixtures and associated equipment
 - s. Lighting system control equipment and devices

4. Substitutions

Catalog numbers and specific brands or trade names followed by designation "or equal" are used in conjunction with material and equipment required by the Specifications to establish the standards of quality, utility, and appearance required. Substitutions which are equal in quality, safety, and appearance to those specified may be accepted, subject to the following provisions:

- a. All substitutions must be submitted in writing to the Owner. Contractor shall submit to the Owner a typewritten list containing a description of each proposed substitute material or equipment.
- b. The Owner will accept, in writing, proposed substitutions that are, in the Owner's opinion, equal in quality, utility and appearance to the material or equipment

specified. Such acceptance shall not relieve Contractor from complying with the requirements of the Drawings and the Specifications.

- c. Contractor shall be responsible for all costs of any changes resulting from Contractor's proposed substitutions which affect other parts of the Work or the work of separate Contractors.
 - 1) Contractor also agrees to compensate the Owner for time and expenses spent reviewing substitutions.
- d. The decision of the Owner shall be final.
- 5. Submit protective device coordination and short circuit calculations conducted and documented to demonstrate: (1) selective coordination, and (2) that electrical equipment and protective devices proposed provide adequate interrupting and withstand capability. The written calculation procedures and tabulated results shall be bound and submitted - six submittal document sets. Section 26 0573 "Protective Device Coordination and Short Circuit Study", is applicable as included in these Specifications.
- 6. Submit test results (also see applicable technical specification sections following for additional requirements), six submittal document sets, for:
 - a. Transformers
 - b. Ground fault protection coordination
 - c. Engine generator system
 - d. Fire alarm system
 - e. All low voltage communication systems
- 7. Submit operating, maintenance and instructional data (also see applicable technical specification sections following for additional requirements), six submittal document sets, for:
 - a. Switchboards
 - b. Engine generators
 - c. Transfer switches
 - d. Fire alarm system
 - e. All low voltage communication systems
- 8. Instruction Materials (also see applicable technical specification sections following for additional requirements), six submittal document sets, for:
 - a. Provide prior to the time of the personnel instruction period, instruction manuals associated with all systems listed above.
 - b. Include the following information, as a minimum, in each copy of the instruction manual:

- 1) Manufacturers' names and addresses.
- 2) Serial numbers of items furnished.
- 3) Catalog cuts, exploded views and brochures, complete with technical and performance data for all equipment, marked to indicate actual items furnished and the intended use.
- 4) Recommended maintenance procedures.

B. Project record documents:

1. Mark Record Documents daily to indicate all changes made in the field.
 - a. In addition to general requirements of Record Documents, indicate on Project Record Drawings all changes of equipment locations and ratings, fuse sizes, trip sizes and settings on magnetic-only circuit breakers.
 - b. Alterations in raceway runs and sizes, changes in wire sizes, circuit designations, installation details, one line diagrams, control diagrams and schedules.
2. Use green to indicate deletions and red to indicate additions.
 - a. Use the same symbols and follow as much as possible the same drafting procedures used on the Contract Drawings.
3. Locate conduit stubbed-out for future use, underground feeder conduits, and feeder pull box locations using building lines by indicating on the Project Record Drawings.

1.05 OPERATING AND MAINTENANCE MANUALS

- A. Prepare and submit Operating and Maintenance Manuals, six document sets. In addition to the requirements specified in Division 1 (also see technical specification sections following for additional requirements), include the following information for equipment items:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers and replacement parts.
 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and, as required, summer and winter operating instructions.
 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 4. Servicing instructions and lubrication charts and schedules.

1.06 QUALITY ASSURANCE

- A. As a minimum Specification requirement, all materials and methods shall comply with applicable governing codes.
- B. Material and equipment substitution.
 - 1. Equipment other than that specified will be accepted only when written approval is given by the Owner, in accordance with Division 1.
 - 2. The Contractor shall be held responsible for all physical changes in piping, equipment, etc. resulting from equipment substitution and likewise bear any increased cost of other trades in making said substitution. Approval by the Owner of equipment other than that specified does not relieve the Contractor of this responsibility.

1.07 OWNER'S INSTRUCTIONS

- A. Prior to completion of the contract, and at the Owner's convenience, instruct verbally and demonstrate to the Owner's personnel, the operation of the systems as listed in Part 1 above.

1.08 SYSTEM STARTUP

- A. Do not energize or place electrical equipment in service until all relevant parties have been duly notified and are present or have waived their rights to be present. Where equipment to be placed in service involves service or connection from another contractor of the Owner, notify the Owner in writing when the equipment will be ready. Notify the Owner's Representative two weeks in advance of the date the various times of equipment will be complete.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Site verification of conditions: Contractor shall survey the entire project site and become thoroughly familiar with actual existing conditions. The intent of the work is shown on the drawings and described hereinafter. By the act of participation in the pre-bid conference and site inspection tour specified in the applicable Division 1 section, the Contractor shall be deemed to have made such a study and examination and to accept all conditions present at the site. No request for additional payment shall be considered as valid, due to failure to allow for conditions which may exist.
- B. Electrical work shown: Electrical drawings are generally diagrammatic. Verify equipment sizes with shop drawings and manufacturers' data and coordinate location layout with other trades. Report immediately to the Owner any conflicts in the drawings and specifications

with any code or between the electrical work and the work of other trades. No work shall be commenced where a conflict exists prior to receiving proper instructions. Any work or materials shown on the drawings and not mentioned in this division, or vice-versa, shall be executed the same as if specifically mentioned by both. Notify the Owner of any changes of location requirements prior to installation.

3.02 SEISMIC BRACING

- A. Contractor shall be responsible for anchors and connections of electrical work to building structure to prevent damage as a result of earthquake, including manufactured equipment, the connection and integrity of shop-fabricated and field-fabricated materials and equipment. All building equipment and connections therefore shall be designed to resist seismic forces in conformance with Title 24 of the California Administrative Code.

Contractor shall submit shop drawings sealed by a Structural Engineer registered in the State of California to demonstrate compliance with the following requirements:

- 1. Electrical equipment: For requirements, see Part 1 above.

3.03 PENETRATION SEALING

- A. Seal penetrations through exterior walls and fire rated walls, floors, and ceilings. Sealing methods used shall be in compliance with the requirements of the Authority Having Jurisdiction to maintain required fire ratings, and shall be in accordance with the applicable sections in Division 7 which prescribe applicable firestopping and weatherproofing of wall, floor, ceiling, and roof penetrations. Seal all conduit penetrations through roofs.

3.04 DEMOLITION, ALTERATION AND EXTENSION WORK

- A. Provide and perform demolition, alteration, extension, preparatory and miscellaneous work as indicated.
- B. Existing Conditions: Make a detailed survey of the existing conditions pertaining to the work. Check the locations of all existing structures equipment, wiring, etc. include all demolition, alteration and extension work in bid.

3.05 SERVICE INTERRUPTIONS AND UTILITY

- A. Coordinate with the Owner any interruption of services necessary to accomplish the work.
- B. Coordinate with the utility company all work associated with power and communications/signal distribution systems and service entrance equipment.

3.06 FIELD QUALITY CONTROL

- A. Site Tests:

1. Perform all necessary tests required to ascertain that the electrical system has been properly installed, that the power supply to each item of equipment is correct, and that the system is free of grounds, ground faults, and open circuits, that all motors are rotating in the proper directions, and such other tests and adjustments as may be required for the proper completion and operation of the electrical system.
2. Test the input and output voltage of each transformer prior to operation under load, and adjust the output voltage by resetting taps, to achieve the specified values. After the system has been placed under load, test transformers under normal operation. Record the measurement of primary and secondary voltages. Reset taps to within 1/2% if necessary to adjust secondary voltage. Submit a report indicating the final result of such tests, and reporting specific current and voltage measurements to the Owner's Representative.
3. If, during the course of testing, it is found that system imbalance is in excess of 20%, rearrange single-pole branch circuits in lighting and receptacle panels to bring system balance within 20% on all phases. Record all such changes on the panelboard schedule and submit a summary of changes to the Owner's Representative.

3.07 CLEANING

- A. Clean exterior surfaces of equipment and remove all dirt, cement, plaster and other debris. Protect interior of equipment from dirt during construction and clean thoroughly before energizing.
- B. Clean-out cracks, corners and surfaces on equipment to be painted, remove grease and oil spots so that paint may be applied without further preparation.
- C. Locate underground conduit stubbed-out for future use, underground feeder conduits, and feeder pull box locations, using building lines by indicating on the Project Record Drawings.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes wire and cable systems rated 600 volts and less:
 - 1. Building wire and cable.
 - 2. Underground feeder and branch circuit cable.
 - 3. Service entrance cable.
 - 4. Armored cable
 - 5. Metal-Clad cable.
 - 6. Nonmetallic-sheathed cable.
 - 7. Wiring connectors and connection accessories.
- B. Cabling requirements in this Section may be supplemented in other sections of these specifications.
- C. Related Sections:
 - 1. General electrical requirements: Section 260501.

1.02 REFERENCES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.
- B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:
 - 1. ANSI American National Standards Institute
 - 2. ASTM American Society for Testing and Materials.
 - 3. Institute of Electrical and Electronics Engineers.
 - IEEE Standard 82 Test Procedures for Impulse Voltage Tests on Insulated Conductors.
 - 4. CEC California Electrical Code (CEC).
 - 5. NECA National Electrical Contractors Association: "Standard of Installation."

6. National Electrical Manufacturers Association/Insulated Cable Engineers Association

NEMA/ICEA WC-5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

NEMA/ICEA WC-7 Cross-Linked Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

NEMA/ICEA WC-8 Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

7. NFPA National Fire Protection Association

8. Underwriters Laboratories, Inc.

UL 4 Armored Cable

UL 62 Flexible Cord and Fixture Wire.

UL 486A Wire Connectors and Wiring Lugs for Use with Copper Conductors

UL 486B Wire Connectors for Use with Aluminum Conductors

UL 83 Thermoplastic-Insulated Wires and Cables.

UL 854 Service Entrance Cables.

1.03 SUBMITTALS

A. General: Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."

B. Samples: Provide samples upon specific request.

C. Product Data: Submit product data giving complete description for sizes employed, material types, and electrical ratings.

D. Certificates:

1. Labels of Underwriters' Laboratories, Inc., fixed to each item of material.

2. If materials are by manufacturers other than those specified submit certification that material meets applicable Underwriters' Laboratories, Inc. Standards.

3. Submit in accordance with Section 260501.

1.04 QUALITY ASSURANCE

A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.

- B. Electrical Component Standard: Components and installation shall comply with CEC, "California Electrical Code."
- C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.
- D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."
- E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.
- C. Deliver wire and cable to the project in full unbroken cartons or reels marked with conductor size, insulation type, and Underwriters' Laboratories, Inc. label.
- D. Handle wire and cable in a manner to prevent damage to conductor, insulation and identifying markings.

1.06 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of wiring system prior to rough-in.
- C. Wire and cable routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, provide products by the following, or equal:

- A. Wire and cable:

Triangle

Anaconda
General Cable Corporation

B. Connectors:

AMP
Buchanan
Burdny
3M Company
O-Z/Gedney
Thomas & Betts

C. Insulating Tapes: 3M Company

D. Wire Ties:

Ideal
Thomas and Betts ("Ty-Rap")
Panduit

E. Pulling Compound: Ideal ("Yellow 77").

2.02 MATERIALS

A. General: Provide wire and cable suitable for the temperature, conditions, and location where installed, except as otherwise indicated.

1. Conductor: Copper. Provide solid conductor for No. 10 AWG and smaller. Provide stranded conductors for sizes No. 8 and larger.

a. Use stranded conductors:

1) At motors and other applications where subject to vibration.

2) For control circuits.

2. Minimum Size Conductor: No. 12 AWG, except as otherwise indicated.

a. Control circuits: No. 14 AWG.

3. Insulation voltage rating: 600 volts.

B. Building wire and cable:

1. Description: Single conductor insulated wire.

2. Insulation: CEC:

a. Type THHN/THWN, rated 75 degrees C.

b. Type XHHW, rated 90 degrees C.

C. Service entrance cable:

1. Description: CEC. Type USE.

2. Insulation: Type RHW.

D. Armored cable:

1. Description: CEC. Type AC.

2. Insulation: Thermoplastic, 75 degrees C.

E. Metal-Clad cable:

1. Description: CEC. Type MC.

2. Insulation: Thermoplastic, 75 degrees C.

3. Armor material: Steel.

4. Armor design: Interlocked metal tape.

5. Jacket: None.

F. Nonmetallic-sheathed cable: CEC. Type NM and NMC.

G. Flexible cord and cable: CEC. Type SO.

H. Connectors:

1. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

I. Pull Cord: 1/8" polypropylene or nylon.

PART 3 - EXECUTION

3.01 WIRING METHOD

A. General:

1. Use insulation types suitable for the temperature, moisture and elements to which exposed.
 - a. Minimum 75°C temperature rated insulation on conductors, except as otherwise indicated.
 - 1) Use minimum 90°C temperature rated insulation on conductors in conduits exposed on roof, or where required due to ambient temperature.
2. Equipment grounding conductors:
 - a. Provide where required by the National Electrical Code, and where indicated. Where conductor size is not indicated, provide size as required by the National Electrical Code.
 - b. Provide for:
 - 1) All branch circuit wiring.
 - 2) All feeders and motor branch circuits
 - 3) All nonmetallic conduits.
 - 4) All flexible metal conduits exceeding 72 inches in length.
3. Use flexible cords and cables for connection of special equipment as indicated. Length not to exceed 72 inches.

B. Wire and cable connections:

1. Connector types:
 - a. No. 10 AWG wire and smaller: Spring-type connectors. All terminations shall be made on device terminals or on terminal blocks.
 - 1) Maximum number of conductors in a connection: 3.
 - b. No. 8 AWG wire and larger: Compression- or pressure-type solderless connectors and terminal lugs. Wrap connection with electrical insulating tape, half-lapped to produce a dielectric value equal to or greater than wire insulation.
2. Provide connector sealing packs for splices that require complete protection from dampness and water where indicated.

3. Splices in feeders and mains may only be made where designated on the drawings and where prior approval is obtained from Owner.
4. Location of splices and terminations shall be limited to accessible locations such as outlet boxes, pull boxes, junction boxes, panelboard boxes, and splice boxes.
5. Insulate taps and splices equal to insulation of adjoining conductor.
6. Splice or tap permitted only on conductors that are a component part of a single circuit properly protected by approved methods.

3.02 PREPARATION

- A. Examine the system in which the wire is to be installed for defects in equipment and installation which may cause damage to the wire.
- B. Examine wires to be jointed, tapped, spliced, terminated, and their connecting devices for defects which may affect the mechanical and electrical integrity of the connection.
- C. Check conduit systems for damage and loose connections, replace damaged sections. Make sure that the inside of conduit is free of dirt and moisture.
 1. Completely and thoroughly swab raceway before installing wire.
 2. Pull mandrel, one size smaller than the conduit, through entire length of all underground conduits prior to conductor installation.
- D. Do not start work until defects have been corrected and until authorization to proceed has been obtained from Owner's Representative.

3.03 INSTALLATION

- A. Install wire, cable, and connectors in compliance with the NEC.
- B. Install products in accordance with manufacturers instructions.
- C. Install all wire in raceway.
- D. When pulling conductors do not exceed manufacturer's recommended values.
- E. Use polypropylene or nylon ropes for pulling conductors.
- F. Do not bend wire less than the manufacturer's recommended minimum bending radius.
- G. Coordinate cable installation with other work.

- H. Protect exposed cable from damage.
- I. Support cables above accessible ceiling, using spring metal clips or cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
- J. Use suitable cable fittings and connectors.
- K. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound where necessary.
- L. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.
- M. Conceal all cable in finished spaces.
- N. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible.
- O. Keep conductor splices to a minimum.
- P. Clean conductor surfaces before installing connectors.
- Q. Tape uninsulated conductors and connectors with electrical insulating tape to 150 percent of insulation rating of conductor.
- R. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.
- S. Use splice and tap connectors which are compatible with conductor material.
- T. Provide adequate length of conductors within electrical enclosures and neatly train the conductors to terminal points with no excess. Make terminations so there is no bare conductor at the terminal.
- U. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.
- V. Circuits of multiple phases passing through enclosures shall have phases grouped (bundled together) to reduce the reactance effect.
- W. Arrange conductors in switchboards, panelboards, gutters, boxes, control cabinets and terminal cabinets neatly and lace with black T & B "Ty-Raps" ties.

X. Connect control circuits as indicated and in accordance with the wiring diagrams furnished by the equipment manufacturer. Control conductors shall be color coded or identified with the provision of non-deteriorating type wire markers.

Y. Consistently color code wiring continuous throughout the work:

1. Color code secondary service, feeder, and branch circuit conductors with insulation/jacket (factory-applied) color for phase identification as follows:

-- System Voltage --

<u>Phase</u>	<u>208Y/120</u>	<u>480Y/277</u>
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

2. Select consistent wiring color code for switch legs, travelers, and special systems.
3. For conductors No. 6 AWG or larger, permanent plastic colored tape may be used to mark conductor in lieu of color-coded insulation/jacket. Tape shall cover not less than 2 inches of conductor insulation within enclosures.

3.04 IDENTIFICATION

A. In addition to requirements in Section 260553, the following are applicable:

1. At all switchboard terminations, provide each feeder circuit with a permanent plastic name tag indicating the load fed.
2. Feeders: Identify with the corresponding circuit designation at over-current device and load ends, at all splices and in pull boxes.
3. Branch Circuits: Identify with the corresponding circuit designation at the over-current device and at all splices and devices.
4. Control Wires: Identify with the indicated number and/or letter designation at all terminal points and connections.
5. Alarm and Detection Wires: Identify with the indicated wire and zone numbers at all connection, terminal points, and coiled conductors within cabinets.
6. Conductors Terminated by Others: Indicate location of opposite end of conductor, i.e., Pull Box-Room 101.
7. For identification of conductors use plastic coated self-sticking markers such as

Thomas & Betts E-Z Code.

8. Circuit Designation is construed to mean panel designation and circuit number, i.e., LA-13.

3.05 FIELD QUALITY CONTROL

A. Prior to energizing:

1. Inspect wire and cable for physical damage and proper connection.
 - a. Confirm that field-connections made by others in equipment furnished by others are mechanically and electrically sound prior to energization.
2. Confirm electrical continuity and absence of short circuits for all wire and cable with the use of a megohm meter.
 - a. Obtain values for phase-to-phase, phase-to-neutral, and phase-to-ground.
3. Confirm required insulation resistance as follows:
 - a. Perform insulation resistance test for all 600 volt insulated conductors No. 8 AWG and larger.
 - b. Use a 500 volt megger.
 - c. Obtain and record values for insulation resistance to ground and for insulation resistance between each conductor and every other conductor in the same conduit.
 - d. Conductors not complying with the following minimum values of insulation resistance are to be replaced and retested until satisfactory.

<u>Conductor Rated Amperes:</u>	<u>Minimum Insulation Resistance, Ohms:</u>
31 through 50	500,000
51 through 100	250,000
101 through 200	100,000
201 through 400	50,000

- e. Perform tests after conductors have been installed, but before terminal connections have been made. Take readings for each test after the voltage has been applied continuously for one minute.
- f. Perform tests according to manufacturer's recommendations.
- g. Test results shall be in accordance with manufacturer's recommendations.

- h. Correct defects revealed by above tests.
- B. Subsequent to wire and cable hook-ups:
 - 1. Energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes basic materials and methods for grounding and bonding electrical systems and equipment. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

1. Grounding electrodes and conductors.
2. Equipment grounding conductors.
3. Bonding.

B. System Requirements

1. Electrical continuity to ground metal raceways and enclosures which are isolated from the equipment ground due to use of conduit or fittings which are nonmetallic (non-conducting), shall be established by providing by a green insulated grounding conductor of approved size within each raceway which shall connect to the isolated metallic raceways or enclosures at supply side. (If bare grounding conductors were specified, connect to enclosure on raceway at both ends.)
2. Cold water or other utility piping systems alone not be used as grounding electrodes due to the use of insulating couplings and nonmetallic pipe in such installation. All grounding electrodes shall be "Made Electrodes" as specified herein.
3. Non-current-carrying metal parts of all high voltage, conduit systems, supports, cabinets and enclosures shall be permanently and effectively grounded.
4. Metallic or semi-conducting shields and lead sheaths of all cables operating at high voltage shall be permanently and effectively grounded at each splice and termination.

C. Related Sections

1. General electrical requirements: Section 260501.

1.02 REFERENCES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.
- B. In addition, the products covered in this Section, except as noted, shall be designed,

manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1. American National Standards Institute.

ANSI C2 National Electrical Safety Code.

2. American Society for Testing and Materials.

ASTM B3 Soft or Annealed Copper Wire.

ASTM 33 Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes.

ASTM B8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

3. Institute of Electrical and Electronics Engineers.

IEEE 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

4. Lightning Protection Code (NFPA 78).

5. CEC California Electrical Code (CEC).

6. NEMA National Electrical Manufacturers Association.

7. NFPA National Fire Protection Association

8. Underwriters Laboratories, Inc.

UL 467 Electrical Grounding and Bonding Equipment.

UL 486A Wire Connectors and Grounding Lugs for Use With Copper Conductors.

UL 96 Lightning Protection Components.

1.03 SUBMITTALS

- A. In addition to this Section, the submittal requirements of Section 260501, "General Electrical Requirements" are applicable.
- B. Product Data: Provide data for grounding electrodes and connections.
- C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.
- D. Operating, Maintenance, and Instructional Data: Manufacturers' written operating, maintenance, and installation instructions, including directions for storage and protection, handling, examination, and preparation. Include specific instructions for preparation and installation of exothermic connectors.

1. In addition, include copies of this data in Operating and Maintenance Manuals submitted, see Section 260501.

1.04 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.
- B. Electrical Component Standard: Components and installation shall comply with CEC, "California Electrical Code."
- C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards for grounding and bonding materials and systems. Provide products and components listed and labeled by UL.
- D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."
- E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.06 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown prior to commencing the work.

1.07 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of grounding electrodes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, provide products by the following, or equal:

Anixter Brothers

Blackburn
Burndy
A.B. Chance Co.
Erico Products (CADWELD)
Joslyn
Kearney-National
O-Z/Gedney
Thomas & Betts

2.02 GROUNDING AND BONDING PRODUCTS

- A. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.
- B. Conductor Materials: Copper.

2.03 WIRE AND CABLE CONDUCTORS

- A. General: Comply with the following, except as otherwise indicated:
- B. Equipment Grounding Conductor: Green insulated copper.
- C. Grounding Electrode Conductor: Stranded copper cable.
- D. Bare Copper Conductors: Conform to the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.

2.04 MISCELLANEOUS CONDUCTORS

- A. Ground Bus: Bare annealed copper bars of rectangular cross section, minimum 1/4 inch x 4 inch x 24 inch drilled and tapped every 2 inches on center for two hole lugs.
- B. Braided Bonding Jumpers: Copper tape, braided No. 30 gauge bare copper wire, terminated with copper ferrules.
- C. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.05 CONNECTOR PRODUCTS

- A. General: Listed and labeled as grounding connectors for the materials used.
- B. Pressure Connectors: High-conductivity plated units.
- C. Bolted Clamps: Heavy-duty units listed for the application.
- D. Exothermic Welded Connections: Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.

2.06 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten-welded to core. Size: 3/4 inch in diameter by 10 feet in length.
- B. Plate Electrodes: Copper plates, minimum 0.10 inch thick, size as indicated.

2.07 TEST (GROUND) WELLS

- A. Precast concrete, 12" round x 18" deep open bottom valve box, with cast iron grate cover plate marked "GROUND."

PART 3 - EXECUTION

3.01 APPLICATION

- A. Equipment Grounding Conductor Application:

Comply with CEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.

- 1. Install separate insulated equipment grounding conductors with circuit conductors for the following in addition to those locations where required by Code:

- a. Feeders and branch circuits.

- B. Underground conductors: Soft bare stranded copper, except as otherwise indicated.

- 1. Install minimum 4/0 AWG soft stranded copper buried ground loop cable as shown on drawings at least 3 feet below finished grade and minimum 3 feet from building.

- C. Signal and Communications System: Provide #4 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location.

- D. Separately Derived Systems: Grounding shall be provided in accordance with the CEC, including Article 250.

E. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to a grounding electrode as indicated in addition to separate equipment grounding conductor run with supply branch circuit.

F. Service Entrance:

1. Grounding Conductor: Shall be sized in accordance with California Electrical Code to connect these items to the building bus in the service main equipment.
2. Equipment Bonding Jumper: Shall be sized in accordance with the California Electrical Code and be conducted on the supply side of the service main equipment.
3. Grounding Electrode: Bond together the following items to establish the electric service grounding electrode, unless otherwise indicated:
 - a. Minimum 20 feet number 3/0 AWG copper conductor encased in concrete footing or grade beam to contact with earth in two opposite directions.
 - b. Building domestic water service entrance piping on house side of meter; provide bonding jumper across meter.
 - c. Structural steel building framework.

G. Flexible metal and liquid-tight conduit: Provide equipment grounding conductors.

H. Rigid nonmetallic conduit: Provide equipment grounding conductors

3.02 INSTALLATION

General: Ground electrical systems and equipment in accordance with CEC requirements except where the drawings or specifications exceed CEC requirements.

- A. Ground Rods: Locate a minimum of one-rod length from each other and at least the same distance from any other grounding electrode. Interconnect ground rods with bare copper conductors buried at least 24 inches below grade. Connect bare copper cable ground conductors to ground rods by means of exothermic welds except as otherwise indicated. Make these connections without damaging the copper coating or exposing the steel. Use 3/4 inch diameter by 10 foot long ground rods except as otherwise indicated. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated.
- B. Metallic Water Service Pipe: Provide insulated copper ground conductors, sized as indicated, in conduit from the building main service equipment, or the ground bus, to main metallic water service entrances to the building. Connect ground conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water fitting is installed, connect the ground conductor to the street side of the fitting. Do not

install a grounding jumper around dielectric fittings. Bond the ground conductor conduit to the conductor at each end.

- C. Ufer System (Concrete-Encased Electrode) Ground: Fabricate with a 20 feet of bare copper conductor laid lengthwise in excavation for foundation or footings. Install so conductor is within 2 inches of the bottom of the concrete. Where base of foundation is less than 20 feet in length, coil excess conductor at base of foundation. Bond conductor to reinforcing steel at four locations, minimum. Extend conductor below grade and connect to building grounding grid or ground electrode.
- D. Braided-Type Bonding Jumpers: Install to connect ground clamps on water meter piping to bypass water meters electrically. Use elsewhere for flexible bonding and grounding connections.
- E. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.
- F. Test Wells: Locate as indicated, and fabricate in accordance with details indicated.
- G. Fences and Gates: See grounding details on the construction drawing for building and fence grounding requirements and details.
 - 1. Use flexible copper braid for bonding the gates of chain link fences.
- H. Cable Shields: Ground shields of any shielded power cable or signal cable at each splice or termination in accordance with recommendations of the splice or termination manufacturer.

3.03 CONNECTIONS

- A. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible. Make connections with clean bare metal at points of contact.
- B. Exothermic Welded Connections: Use for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and plate electrodes. Comply with manufacturer's written recommendations. Do not alter molds. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare copper grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances

and exits with grounding bushings and bare copper grounding conductors.

- D. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- F. Compression-Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.
- G. Moisture Protection: Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.
- H. Ground Bus Assembly: Make connections to the ground bus assembly in the following manner:
 - 1. Bond cable to two hole lug using exothermic welding process.
 - 2. Bolt two hole lugs to ground bus assembly.

3.04 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Manholes and Handholes: Install a 3/4 inch diameter by 10 foot long driven ground rod close to the wall and set the rod depth such that 4 inches will extend above the finished floor. Where necessary, install ground rod before the manhole is placed and provide a #4/0 bare tinned-copper conductor from the ground rod into the manhole through a waterproof sleeve in the manhole wall. Protect ground rods passing through concrete floor with a double-wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below the concrete. Seal floor opening with waterproof nonshrink grout.
- B. Connections at Manholes: Connect exposed metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole to the ground rod or ground conductor. Make connections with a minimum #2 AWG stranded hard-drawn copper wire. Train conductors plumb or level around corners and fasten to manhole walls. Connect to cable armor and cable shields by means of tinned terminals soldered to the armor or shield, or as recommended by manufacturer of splicing and termination kits.
- C. Grounding System: Ground non-current-carrying metallic items associated with manholes, substations, and pad-mounted equipment by connecting them to bare underground copper

cable and grounding electrodes arranged as indicated.

3.05 FIELD QUALITY CONTROL

- A. Test all ground fault interrupter (GFI) receptacles and circuit breakers for proper connection and operation with methods and instruments prescribed by the manufacturer.
- B. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground resistance level is specified, at service disconnect enclosure ground terminal, and at ground test wells. Measure ground resistance without the soil being moistened by any other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the two-point method in accordance with Section 9.03 of IEEE 81.
- C. Ground/resistance maximum values shall be as follows:
 - 1. Equipment rated 500 kVA and less: 10 Ohms.
 - 2. Equipment rated 500 kVA to 1000 kVA: 5 Ohms.
 - 3. Equipment rated over 1000 kVA: 3 Ohms.
 - 4. Unfenced substations and pad-mounted equipment: 5 Ohms.
 - 5. Manhole and handhole grounds: 10 Ohms.
 - 6. Grounded secondary distribution system neutral and non-current carrying parts associated with distribution systems and grounds not otherwise covered: 25 ohms.
- D. Deficiencies: Where ground resistances exceed specified values, and if directed, modify the grounding system to reduce resistance values. Where measures are directed that exceed those indicated, the provisions of the Contract covering the changes shall apply.
- E. Report: Prepare test reports, certified by the testing organization, of the ground resistance and device function tests at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 - 1. Provide copies of reports of all grounding system tests for inclusion in Operation and Maintenance Manuals and for review by the Owner.

END OF SECTION

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SECTION 260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes provision of a mechanically- and electrically-complete conduit system including:

1. Rigid metal conduit.
2. Intermediate metal conduit.
3. Electrical metallic tubing.
4. Rigid nonmetallic conduit.
5. Flexible metal conduit.
6. Liquidtight flexible conduit.
7. Wireways (and auxiliary gutters).
8. Surface raceway.
9. Fittings and conduit bodies; accessories.

B. Related Sections:

1. General electrical requirements: Section 260501.

1.02 REFERENCES

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

A. American National Standards Institute

ANSI C80.1	Specification for Rigid Steel Conduit, Zinc-Coated.
ANSI C80.3	Specification for Electrical Metallic Tubing, Zinc-Coated.
ANSI C80.5	Rigid Aluminum Conduit.
ANSI/NEMA FB 1	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

B. American Society for Testing and Materials.

ASTM 123	Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.

- C. IEEE Institute of Electrical and Electronics Engineers.
- D. CEC California Electrical Code (CEC).
- E. NECA National Electrical Contractors Association: "Standard of Installation."
- F. National Electrical Manufacturers Association

NEMA RN 1 PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

NEMA TC 2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.

NEMA TC 6 PVC and ABS Plastic Utilities Duct for Underground Installation.

NEMA TC 9 Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.

- G. NFPA National Fire Protection Association

- H. Underwriters Laboratories, Inc.

UL 1 Flexible Metal Electrical Conduit

UL 6 Rigid Metal Electrical Conduit.

UL 94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

UL 360 Liquidtight Flexible Steel Conduit, Electrical.

UL 514B Fittings for Conduit and Outlet Boxes.

UL 651 Rigid Nonmetallic Electrical Conduit.

UL 797 Electrical Metallic Tubing.

UL 1242 Intermediate Metal Conduit

1.03 SUBMITTALS

- A. General: Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Product data: For all raceway products.
- C. Contractor shall be responsible for anchors and connections of electrical work to building structure to prevent damage as a result of earthquake, including the connection and integrity of field-fabricated materials and equipment. All building connections therefore shall be designed to resist seismic forces in conformance with Title 24 of the California Administrative Code.

Contractor shall submit shop drawings sealed by a Structural Engineer registered in the State of California to demonstrate compliance with the following:

Component Anchorage Requirements:

All mechanical, plumbing, and electrical components shall be anchored and installed per the details on the DSA approved construction documents. Where no detail is indicated, the following components shall be anchored or braced to meet the force and displacement requirements prescribed in the 2022 CBC. Sections 1616A.1.18 through 1616A.1.26 and ASCE 7-16 Chapter 13, 26 and 30:

All permanent equipment and components.

Temporary or movable equipment that is permanently attached (e.g. hard wired) to the building utility services such as electricity, gas or water shall include electrical connections except plugs for 110.220 volt receptacles having flexible cable.

Temporary, movable or movable equipment which is heavier than 400 pounds or has a center mass located 4 feet or more above the adjacent floor or roof level that directly support the components is required to be restrained in a manner approved by DSA.

The following mechanical and electrical components shall be positively attached to the structure but need not demonstrate design compliance with the references noted above. These components shall have flexible connections provided between the component and the associated ductwork, piping and conduit flexible connections must allow movement in both transverse and longitudinal directions.

Components weighing less than 400 pounds and have a center of mass located 4 feet or less above the adjacent floor or roof level that directly support the component.

Components weighing less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.

Piping, Ductwork, and Electrical Distribution System Bracing requirements:

Piping, ductwork, and electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7 Section 13.3 as defined in ASCE 7 Section 13.6.5, 13.6.6, 13.6.7 and 13.6.8; and 2022 CBC, Section 1617A.1.24, 1617A.1.25 and 1617A.1.26.

The method of showing bracing and attachments to the structure of the identified distribution system are as noted below. The MEP design professional engineer responsible for content on these sheets has verified that the design methods identified below are in accordance with DSA IR 16-13.

Mechanical piping (MP), mechanical ducts (MD), plumbing piping (PP),
electrical distribution systems (E):

Option 1: Project-Specific Design

Option 2: Design based on OSHPD OPM, within project submittal

Option 3: Design based on OSHPD OPM, deferred submittal.

D. Samples: Provide samples upon specific request

E. Installation instructions: Manufacturer's written installation instructions for wireway, surface raceway, and nonmetallic raceway products. Include instructions for storage, handling, protection, examination, and preparation of Product.

F. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

G. Substitutions: If materials are by manufacturers other than those specified, submit product data giving complete description for sizes employed, material types, and installation methods.

H. Certificates:

1. Labels of Underwriters' Laboratories, Inc. affixed to each item of material.

2. If materials are by manufacturers other than those specified, submit certification of what material meets applicable Underwriters' Laboratories, Inc. Standards.

1.04 QUALITY ASSURANCE

A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.

B. Electrical Component Standard Components and installation shall comply with CEC, "California Electrical Code."

C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.

D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation".

E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.05 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store, protect, and handle products to site in accordance with the

General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."

- B. Store and protect product in accordance with manufacturers' instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.
- C. Protect conduits from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.06 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

1.07 SEQUENCING AND SCHEDULING

- A. Coordinate with other Work:
 - 1. Install conduits before concrete is placed, and in advance of masonry work.
 - 2. Install conduits through roof in time to be flashed prior to roofing application.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, provide products by the following, or equal:

A. Conduit Bodies:

Adalet-PLM
Appleton Electric
Carlon
Crouse Hinds
Killark Manufacturing
OZ/Gedney
Spring City Electrical Mfg.

B. Wireway and Auxiliary Gutters:

Circle AW

Hoffman Engineering
Surface Metal Raceway:
Alrey-Thompson
B-Line
Isotrol
Square D
Wiremold

C. Surface Nonmetallic Raceway:

Carlon
Hubbell
Panduit
Wiremold

2.02 METAL CONDUIT AND TUBING

A. Rigid Metal Conduit: Steel, hot-dipped galvanized including the threads, with an outer coating of zinc bichromate, complete with one coupling and one end thread protector, manufactured in accordance with ANSI C80.1 and UL 6.

1. Threaded, hot-dipped galvanized fittings manufactured in accordance with ANSI C80.4.
2. Where indicated, provide galvanized rigid steel conduit and fittings with polyvinyl chloride (PVC) coating of nominal .020-inch (20 mil) thickness conforming to NEMA Standard No. RN-1, Type A, Robroy Industries, or equal.

B. Intermediate Metal Conduit: Hot-dipped galvanized steel including the threads, manufactured in accordance with UL 1242.

C. Electrical Metallic Tubing: Welded, electro-galvanized thin wall steel tubing, manufactured in accordance with ANSI C80.3 and UL 797.

1. Maximum size shall be 2 inches.
2. Provide compression type fittings in all areas.
 - a. Gland compression type, zinc plated steel body, cadmium plated malleable iron nut, O-Z/Gedney
 - b. Indenter type or set screw fitting are not acceptable.

D. Flexible metal Conduit: Hot-dipped galvanized steel interlocking, single-strip type manufactured in accordance with UL1.

1. Squeeze type, malleable iron, cadmium plated, straight and angle connectors for all

sizes and twist-in connectors for 1/2-inch and 3/4-inch flexible metal conduit.

2. Integral copper ground wire on sizes 1-1/4" and smaller.

E. Liquidtight Flexible Conduit: Hot-dipped galvanized steel strip core with extruded liquid-tight polyvinyl jacket. Use O-Z/Gedney Type UAG, or equal.

1. Liquid-tight fittings. ANSI/NEMA FB 1.

2. Connectors: Cadmium plated malleable iron body and nut, cadmium plated steel ferrule, insulated throat, integral cast external ground lug, O-Z/Gedney.

2.03 NONMETALLIC CONDUIT AND DUCTS

A. Rigid Nonmetallic Conduit: Polyvinyl chloride (PVC) heavy-wall conduit, with tapered sleeve couplings, rated and labeled for use with 90°C rated conductors, manufactured in accordance with ANSI C33.91.

1. Cemented type fittings of the same manufacturer as the conduit.

2. NEMA TC 2 and UL 651, Schedule 40.

B. PVC Conduit and Tubing Fittings

1. NEMA TC 3. Match to conduit or conduit/tubing type and material.

C. Underground PVC and ABS Plastic Utilities Duct

1. NEMA TC-6, Type I for encased burial in concrete, Type II for direct burial.

D. PVC and ABS Plastic Utilities Duct Fittings

1. NEMA TC 9-1. Match to duct type and material.

E. Liquidtight Flexible Nonmetallic Conduit and Fittings

1. UL 1660. Fittings shall be specifically approved for use with this raceway.

F. Conduit, Tubing, and Duct Accessories

1. Types, sizes, and materials complying with manufacturer's published product information. Mate and match accessories with raceway.

2.04 CONDUIT BODIES

A. General

1. Types, shapes, and sizes as required to suit individual applications and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.

B. Metallic Conduit and Tubing

1. Use metallic conduit bodies. Use bodies with threaded hubs for threaded raceways.

2.05 WIREWAYS AND AUXILIARY GUTTERS

- A. General: Electrical wireways shall be of types, sizes, and number of channels as indicated. Fittings and accessories including but not limited to couplings, offsets, elbows, expansion joints, adapters, hold-down straps, and end caps shall match and mate with wireway as required for complete system. Where features are not indicated, select for fulfill wiring requirements comply with applicable provisions of CEC.

B. Wireways covers shall be hinged type.

1. Use sheet steel wireways with screw-on covers and corrosion resistant hardware. For dry locations coat with rust inhibitor and finish with gray baked enamel. For wet locations use hot-dipped galvanized material finished with gray baked enamel, provide gaskets for covers.

2.06 SURFACE RACEWAY

A. General

1. Sizes and channels as indicated. Provide fittings that match and mate with raceway.

B. Surface Metal Raceway

1. Construct of galvanized steel with snap-on covers, with 1/8-inch mounting screw knockouts in base approximately 8 inches o.c. Finish with manufacturer's standard prime coating suitable for painting. Provide raceways of types suitable for each application required. Provided by Hoffman Engineering Co., The Wiremold Co., or approved equal.

C. Surface Nonmetallic Raceway

1. Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color. Raceway and system components shall meet UL 94 requirements for nonflammable, self-extinguishing characteristics. Provided by Hubbell, Inc., Panduit Corp., The Wiremold Co., or approved equal.

2.07 ACCESSORIES

- A. General: Reducers, bushings, washers, etc., shall be cadmium plated malleable iron of

the shape and dimension best suited for the application.

- B. Seals for Walls and Floor Penetrations: Malleable iron body, oversize sleeve, sealing ring, pressure clamp and rings and sealing grommet, hex head cap screws, O-Z/Gedney Type FSK, or equal.
- C. Fire Seals: Heat activated intumescent material, elastomeric sealing ring, socket head cap screws, steel pressure discs and flange, O-Z/Gedney Type CFSF, Nelson Flame Seal, or equal.
- D. End bells: Hot-dipped galvanized, threaded malleable iron, O-Z/Gedney Type THS, or equal.
- E. Bushings:
 - 1. 1-1/4" and smaller: High-impact thermo-setting phenolic, 150°C, O-Z/Gedney Type "A", or equal.
 - 2. 1-1/2" and larger: Hot-dipped galvanized with thermosetting phenolic insulation, 150°C, O-Z/Gedney Type "B", or equal.
- F. Locknuts:
 - 1. 1-1/2" and smaller: Zinc plated heavy stock steel, O-Z/Gedney, or equal.
 - 2. 2" and larger: Cadmium plated malleable iron, O-Z/Gedney, or equal.
- G. Hubs: Cadmium plated malleable iron, tapered threads, neoprene "O" ring, insulated throat, O-Z/Gedney, or equal.
- H. Expansion Fittings: Hot-dipped galvanized malleable iron with bonding jumpers.
 - 1. Linear: O-Z/Gedney Type AX and TX, or equal.
 - 2. Linear, with deflection: O-Z/Gedney Type AXDX, or equal.
- I. Escutcheons: Chrome plated sectional floor and ceiling plates, Crane No. 10, or equal.

PART 3 - EXECUTION

3.01 WIRING METHOD

- A. General: The wiring method shall be as follows, except as otherwise noted.
- B. Exterior:
 - 1. Exposed: Rigid steel conduit.

2. Concealed: Rigid steel conduit.
 - a. In or under slab on grade: Nonmetallic conduit, Schedule 40 PVC. Conduit leaving the slab (including exposed conduit riser) shall be rigid steel conduit.
3. Underground, single run: Rigid nonmetallic conduit. Use Schedule 40 PVC. Provide concrete encasement as indicated.
4. Underground, grouped: Rigid nonmetallic conduit. Use Schedule 40 PVC. Provide concrete encasement as indicated.
5. Connection to vibrating equipment, including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment: Liquidtight flexible metal conduit, maximum length 18 inches.

C. Interior:

1. Exposed: Electrical metallic tubing.
 - a. Areas where exposed conduit may be subject to physical damage: Rigid metal conduit.
 - b. Damp or wet locations: Rigid metal conduit.
 - c. Classified locations: Rigid metal conduit.
2. Concealed: Electrical metallic tubing.
 - a. In or under slab on grade: Nonmetallic conduit, Schedule 40 PVC. Conduit leaving the slab (including exposed conduit riser) shall be rigid steel conduit.
 - b. In slab, above grade: Rigid nonmetallic conduit Schedule 40 PVC. Maximum size conduit in slab: 1 inch.
3. Connection to vibrating equipment, including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment: Flexible metal conduit, maximum length 18 inches.
 - a. For moist or humid locations or corrosive atmosphere, or where subject to water spray or dripping oil, grease, or water: Liquidtight flexible metal conduit.
4. Connection to lighting fixtures located in suspended acoustical or metal ceilings: Flexible metal conduit, maximum length 72 inches.
5. Final connections to lighting fixtures which have isolated junction boxes: Flexible metal conduit.

- a. Damp locations: Liquidtight flexible conduit.

3.02 INSTALLATION

A. General Requirements:

1. Install electrical raceways in accordance with manufacturer's written installation instructions, applicable requirements of NEC, and as follows.
 - a. Minimum size: 3/4 inch unless otherwise indicated.
 - b. Size conduits as indicated on the drawings and as required by the CEC for the number and sizes of wires to be installed into the conduit.
 - c. Make conduit field cuts square with saw and ream out to full size. Shoulder conduits in couplings. Remove burrs, and swab inside conduits before conductors are pulled in.
 - d. Make all conduit joints mechanically tight, electrically continuous, and watertight. Pitch conduits in a manner to avoid creating moisture traps.
 - e. Install minimum 3/16" polypropylene pull cords from end-to-end in all empty raceways, tagged with the identification of service intended and location of opposite end. Leave at least 24 inches of pull cord at each end.
 - f. Restore wall, ceiling, and floor penetrations to the requirements of the Authority Having Jurisdiction.
 - g. Supports for raceways and electrical systems shall be provided under the guidelines of section 1.03(C) of this specification.
 - 1) Not used.
 - h. Communications/Signal System Raceways 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways 2-inch and smaller trade size in maximum lengths at 150 feet and with a maximum of two, 90-degree bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.
 - i. Provide code sized green grounding conductor in all non-metallic conduit.
2. Perform excavating, trenching, backfillings, and compacting as shown, and as specified in the section in Division 2 which prescribes excavation, backfilling and compacting for utilities. Minimum cover for runs below finished grade outside

buildings: 24 inches except where noted.

3. Complete installation of electrical raceways before starting installation of conductors within raceways.
 - a. Protect inside of conduit from dirt and rubbish during construction by capping all openings with plastic caps intended for the purpose. Cap or plug conduits with standard manufactured accessories as soon as the conduits have been permanently installed in place.
4. Install all conduits at elevations and locations to avoid interference with grading or other work, the structure, finished ceilings, walls. Avoid causing cutting of masonry structural members.
 - a. Do not place conduits in close proximity to equipment, systems, and service lines, such as hot water supply and return lines, which could be detrimental to the conduit and its contents. Maintain a minimum 3" separation, except in crossing, which shall be a minimum 1".
 - 1) Minimum separation from uninsulated hot water pipes, steam pipes, heater flues or vents: 6 inches. Avoid running conduit directly under water lines.
 - 2) Elevation of Raceway: Where possible, install horizontal raceway runs above water and steam piping.
5. Conceal conduit, unless indicated otherwise, within finished walls, ceilings, and floors. Keep raceways at least six (6) inches away from parallel runs of flues and steam or hot water pipes. Install raceway level and square and at proper evaluations.
 - a. To prevent displacement, securely support and hold in place all conduits installed in advance of other work and to be concealed in the building structure. Carefully lay out conduits run within the structure, such as floors, beams, walls, to avoid densities excessive for the construction. Relocate those conduits when excessive densities occur.
 - b. Run conduits embedded in structural slabs in the middle of the slab below the top and above the bottom reinforcing steel. Minimum cover for conduit in concrete floors, walls or roof: 1/3 thickness of slab, but in no case less than 1-1/2" cover except where penetration is made. Do not install conduit larger than 1" in slabs. Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in the concrete. Where nonmetallic conduit is used, raceways must be converted to Schedule 80 or rigid steel conduit before rising above the floor.
 - c. Where conduit installed in concrete or masonry extends across building construction joints, provide expansion fittings as manufactured by O.Z.; Crouse-Hinds; Appleton; or equal, with approved ground straps and clamps. Expansion

fittings installed in concrete shall be water tight - concrete tight deflection/expansion type.

- d. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated. This does not apply to conduits in crawl spaces.
6. Install and neatly rack exposed conduits parallel with and perpendicular to building walls. Do not install exposed diagonal conduit runs.
 - a. Run exposed, parallel, or banked raceways together. Make bends in parallel or banked runs from the same center line so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run such as from wall to ceiling and that the raceways be of the same size. In other cases provide field bends for parallel raceways.
 - b. Use blockouts for concentrations of conduits in a confined area.
 - c. Route and suspend conduits crossing expansion joints to permit expansion, contraction, and deflection utilizing approved fittings to prevent damage to the building, conduits, and supporting devices.
 - d. Install exposed raceways parallel and perpendicular to nearby surfaces of structural members and follow the surface contours as much as practical.
 - e. Provide conduit bodies for exposed conduit runs at junctions, bends or offsets where required. Do not use elbows or bends around outside corners of beams, walls or equipment. Make conduit body covers accessible.
 7. Concrete Wall or Slab Penetrations: All core drilling, sleeves, blockouts or other penetrations must be approved by the Structural Engineer prior to installation.
 - a. Space sleeves and core drills to insure a minimum dimension of 3 times the nominal trade diameter of the largest adjacent conduit between sleeves or core drills.
 - b. Use blockouts for concentrations of conduits in a confined area.
 8. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.
 9. Make bends and offsets so the inside diameter is not effectively reduced. Unless

otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

- a. Make no bends with a radius less than 12 times the diameter of the cable it contains nor more than 90 degrees. Make field bends with tools designed for conduit bending. Heating of metallic conduit to facilitate bending is not permitted.
- b. Bends and offsets in 1" and smaller conduits may be done with approved bending devices. Do not install conduits which have had their walls crushed and deformed and their surface finish damaged due to bending.
- c. Run conduits parallel to and at right angles to building lines.
- d. Where space conditions prohibit the use of standard ells, elbows, and conduits, use cast ferrous alloy fittings of such forms and dimensions as best required for application.

10. Surface Raceway:

- a. Install a separate green ground conductor in raceway from the junction box supplying the raceway to receptacle of fixture ground terminals.
- b. Select each surface raceway outlet box to which a lighting fixture is attached to be of sufficient diameter to provide a seat for the fixture canopy.
- c. Where a surface raceway is used to supply a fluorescent lighting fixture having central stem suspension with a backplate and a canopy, with or without extension ring, the backplate and canopy will serve as the outlet box and no separate outlet box need be provided.
- d. Provide surface raceway outlet box, in addition to the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end stem suspension.
- e. Where a surface raceway extension is made from an existing outlet box on which a lighting fixture is installed, provide a backplate slightly smaller than the fixture canopy, and no additional surface mounted outlet box need be installed.
- f. Surface raceways shall be securely fastened to the mounting surface. Use expansion type anchors in concrete.

11. Do not run conduits exposed on the roof unless approval is obtained from the Owner prior to installation.

B. Other Requirements:

1. Connect motors, equipment containing motors, equipment mounted on an isolated foundation, transformers, and other equipment and devices which are subject to vibration and which require adjustment with flexible metallic conduit from the device to the conduit serving it. Size the flexible conduit length more than 12 diameters, but less than 18 diameters. Rigidly support the points of attachment on each side of the connection. Use external bonding jumpers on sizes 1-1/2" and above.
2. Install escutcheons on all exposed conduits passing through interior floors, walls, or ceilings. Install fire seals on all conduits passing through fire rated partitions. Install wall and floor fire seals on all conduits passing through exterior walls and floors, or use standard galvanized steel pipe sleeves; diameters 12" greater than the outside diameter of the sleeved conduit and fill the annular space with mastic or caulk with lead.
3. Fire pump room: All wiring shall be installed in rigid metal, liquid-tight flexible metal conduit.
4. Raceway for panelboards:
 - a. All homeruns shown shall be run to the panel indicated independently of all other homeruns. Provide pull points so as not to exceed total bends of 270 degrees.
 - b. Run a minimum of one 3/4-inch empty conduit for every three single pole spare circuit breakers, spaces or fraction thereof and not less than two 3/4-inch conduits from every flush mounted panel to an accessible space above the ceiling and below the floor.
5. Make conduit projections from covered areas to areas exposed to the weather watertight by proper flashing. Extend flashing a minimum of 6 inches in all directions from conduit.
6. Cap conduits indicated to be stubbed-out underground using glued on PVC caps intended for this purpose.
7. Install a coupling flush with the floor on all conduits stubbed-up through the floor slab.
8. Do not penetrate walls with flexible conduit where subject to physical damage. Use recessed box with extension ring for transition from interior to exterior of wall.
9. Terminations:
 - a. Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

- b. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
 - c. At switchboards, manholes and floor standing distribution panelboards, provide insulated throat bushings or bell ends on all non-metallic conduit entries and bushings on all metallic conduit entries.
 - d. Install insulated throat threaded hubs on conduits entering enclosures without threaded hubs.
 - e. Install end bells on conduits stubbed through slabs and foundations into electrical enclosures.
10. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL- listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
- a. Where conduits enter or leave hazardous locations.
 - b. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
 - c. Where required by the CEC.
11. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used six (6) inches above the floor. Where equipment connections are not made under this contract, install screwdriver-operated threaded flush plugs flush with floor.
- a. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so that curved portion of bends is not visible above the finished slab.
12. Flexible Connections: Use short length (maximum of 6 feet) of flexible conduit for recessed and semi-recessed lighting fixtures, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet locations. Install separate ground conductor across flexible connections.
13. PVC Coated Rigid Steel Conduit:
- a. Do not store conduit in direct sunlight.

- b. Use pipe straps, no pipe wrenches or channel wrenches, when tightening connections to avoid damaging PVC coating.
 - c. Patch all gouges or cuts in the PVC coating after installing conduit. Use manufacturer's recommended patching paste. Build up area to be patched to full mil thickness of coating and feather out paste on sides of damaged area a minimum of 1/2-inch to provide a completely bonded seal.
 - d. Field bend conduit with shoes for a mechanical bender sized for the next larger size conduit.
 - e. Bends used in or below concrete slabs shall be, rigid steel type elbows, use for all stub-ups with flush floor coupling at transitions.
14. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.

3.03 FIELD QUALITY CONTROL

- A. Examine surfaces to which conduits are to be secured for:
 - 1. Defects which will adversely affect the execution and quality of work.
 - 2. Deviations from allowable tolerances for the building material.
- B. Do not start work until defects and deviations are corrected.

3.04 CLEANING

- A. Upon completion of installations of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

3.05 PROTECTION OF FINISHED WORK

- A. Protect inside of conduit from dirt and rubbish during construction by capping all openings with plastic caps intended for the purpose.
- B. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

END OF SECTION

SECTION 260543
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Ducts.
2. Ductbanks.
3. Manholes, handholes, and precast concrete pullboxes.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 31 Section "Earthwork," for general requirements for excavation, backfill, and related items for ducts, manholes, handholes, and precast concrete pullboxes.
2. Division 3 Section "Concrete Work," for cast-in-place concrete requirements.
3. Division 7 Section "Bituminous Waterproofing," for waterproofing of manholes and handholes.
4. General electrical requirements: Section 260501.

1.02 REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1. American Association of State Highway and Transportation Officials

AASHTO H 20

2. American National Standards Institute.

ANSI C2 National Electrical Safety Code.

ANSI C80.1 Specification for Rigid Steel Conduit, Zinc-Coated.

ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit
and Cable Assemblies.

3. American Society for Testing and Materials.

- ASTM C 478 Specification for Precast Reinforced Concrete Manhole Sections.
- ASTM C 891 Practice for Installation of Underground Precast Concrete Utility Structures.
- ASTM 123 Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
4. Federal Specification [from General Services Administration]
- FS RR-F-621 Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole.
5. IEEE Institute of Electrical and Electronics Engineers.
6. CEC California Electrical Code (CEC).
7. National Electrical Manufacturers Association.
- NEMA RN 1 PVC Externally-Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- NEMA TC 6 PVC and ABS Plastic Utilities Duct for Underground Installation.
- NEMA TC 8 Extra-Strength PVC Plastic Utilities Duct for Underground Installation.
- NEMA TC 9 Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.
8. NFPA National Fire Protection Association
9. Underwriters Laboratories, Inc.
- UL 651 Schedule 40 and 80 PVC Conduit.

1.03 SUBMITTALS

- A. In addition to this Section, the submittal requirements of Section 260501, "General Electrical Requirements" are applicable.
- B. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes, handholes, and pullboxes.
- C. Product Data: Provide for conduit and duct, and manhole, handhole, and pullbox accessories.
- D. Manufacturer's Instructions: Include instructions for storage, handling, protections, examination, preparation, and installation.

1.04 DEFINITIONS

Duct: The general term for electrical conduit and other raceway, either metallic or nonmetallic, specified for use underground, embedded in earth or concrete.

Duct Bank: A group of two or more ducts in a continuous run between two points.

Handhole: A below-the-surface enclosure in connection with ducts into which people reach, but do not enter, for the purpose of installing, operating, or maintaining equipment or wiring.

Manhole: A below-the-surface enclosure or chamber, large enough for a person to enter, connecting with ducts, and affording facilities for installing, operating, and maintaining equipment or wiring.

1.05 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of exact routing of ductbank.
- B. Accurately record actual locations of each pullbox, handhole and manhole.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with a minimum of three years documented experience.

1.07 QUALITY ASSURANCE

- A. Electrical component standard: Components and installation shall comply with CEC, "California Electrical Code."
- B. NEMA compliance: Comply with applicable requirements of NEMA standards pertaining to conduits and ducts.
- C. UL compliance and labeling: Comply with applicable requirements of UL standards pertaining to electrical ductbank systems. Provide ductbank products and components listed and labeled by UL, ETL, or CSA.
- D. Test Mandrel:
 - 1. Swab and pull mandrel, 1/4" smaller in diameter than the conduit, through the entire length.
 - 2. If any obstructions are encountered, locate and replace the obstructed area. Then retest the duct bank system.

1.08 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.09 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of duct bank prior to excavation for rough-in.
- C. Verify locations of pullboxes, handholes, and manholes prior to excavating for installation.
- D. Duct bank routing is shown on Drawings in approximate locations unless dimensions are indicated. Route as required to complete duct system.
- E. Pullbox, handhole, and manhole locations are shown on Drawings in approximate locations unless dimensions are indicated. Route as required to complete duct system.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers:

Subject to compliance with requirements, provide products by the following, or equal:

- 1. Metal Conduit and Fittings: Triangle, Pittsburgh, Robroy, Spang, Steel City, NEPCO.
 - 2. Nonmetallic Conduit and Fittings: Carlon, or equal.
- B. Rigid Nonmetallic Conduit: Polyvinyl chloride (PVC) heavy-wall conduit, with tapered sleeve couplings, rated and labeled for use with 90°C rated conductors, manufactured in accordance with ANSI C33.91.
- 1. Cemented type fittings of the same manufacturer as the conduit.

2. NEMA TC 2 and UL 651, Schedule 40.

C. Rigid Metal Conduit: Hot-dipped galvanized steel including the threads, with an outer coating of zinc bichromate, complete with one coupling and one end thread protector, manufactured in accordance with ANSI C80.1 and UL 6.

1. Threaded, hot-dipped galvanized fittings manufactured in accordance with ANSI C80.4.

2. Where indicated, provide galvanized rigid steel conduit and fittings with polyvinyl chloride (PVC) coating of nominal .020 inch (20 mil) thickness conforming to NEMA Standard No. RN-1, Type A.

D. Underground PVC and ABS Plastic Utilities Duct

1. NEMA TC-6, Type I for encased burial in concrete, Type II for direct burial.

E. PVC and ABS Plastic Utilities Duct Fittings

1. NEMA TC 9-1. Match to duct type and material.

F. Duct Accessories

1. Types, sizes, and materials complying with manufacturer's published product information. Mate and match accessories with raceway.

G. Precast Concrete Pullboxes

1. Concrete pullboxes shall be Parkway or Traffic type, as required by location use. Pre-cast in sections with cover marked "Electric" or "Telephone" and with brass hexhead screws. Traffic type shall be constructed for H-20 loading. Acceptable manufacturers: Brooks, Jensen or Quickset.

H. Precast Concrete Manholes

1. Pre-cast, rectangular, with opening complete with cover. Sizes as indicated on the drawings and, in no case, of less size or material thickness than required by the governing code or utility company requirements. Provide with complete necessary hardware. All ferrous material shall be hot dip galvanized after fabrication. Care shall be exercised in locating boxes to avoid installation in drain water flow areas, and disruption of existing utilities.

2. Provide precast steel reinforced concrete box complete with all accessories, cable racks and supports, extension rings, pumps, drains, facilities, etc., sized as indicated on drawings. Each section shall have suitable knockouts or openings in vertical walls

for all duct banks and conduits entering the assembled structure.

3. Each casting shall be identified by having the manufacturers' name and address cast into an interior face or permanently attached thereto. The complete assembly, including frame and cover, shall be rated for AASHTO H-20 Bridge Loading. Submit manufacturer's certificate showing compliance with structural requirements.
 - a. All covers shall be rated for supporting motor vehicle traffic.
 - b. Provide all covers with appropriate utility system description cast in the cover or by bead weld. Unless otherwise indicated, the inscription shall indicate:

Power: "ELECTRIC"

Communications or Signal: "COMMUNICATIONS" or "SIGNAL"

4. Frames, covers and gratings shall be made of cast iron or galvanized steel. Steel frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Steel grating shall be of welded galvanized construction and conform to requirements of RR-G-661, Type 1. Provide concrete ring(s) to bring top cover to required elevation. Concrete ring(s) shall be of sufficient height to provide 24" minimum earth cover over the top of box roof, unless otherwise indicated.
5. Pulling irons shall be steel bars bent in a "U" shape, and cast in the walls and floors. In the floor, they shall be centered, and in the wall they shall not be less than 6 inches above or below, and opposite the knockout panels for conduit. Pulling irons shall project into the box approximately 4 inches. Irons shall be hot dip galvanized.
6. Vertical cable racks, including hooks and porcelain insulator cable cradles, shall be sufficient to accommodate the cables.
 - a. The wall bracket shall be channel or T-section steel.
 - b. The hooks shall be of steel or malleable iron and shall be of the removable type.
 - c. The vertical portion of racks shall be hot-dip galvanized steel after fabrication.
 - d. Vertical racks shall be installed on all walls of the manhole a minimum of 18" on center x 60" high. A rack shall be installed within 12" of each corner of each wall. Additional racks spaced equally on each wall shall be installed.
 - e. Wall racks shall be slotted to accept removable hooks and lock hooks into place.
 - f. All fastening hardware, bolts, washers and nuts shall be hot dip galvanized steel.
 - g. Provide 5/8 in. diameter anchor bolts and concrete inserts to support each cable

rack.

- h. Use Underground Devices Inc. No. CR36, RA08, SB1ON cable rack, or equal, hot dipped galvanized, for each box.
 - i. Use Underground Devices Inc. No. CR36, RA08, SB1ON cable hook, or equal, hot dipped galvanized, to mount on each cable rack.
 - j. Use T & B tie rap, self-locking, cable ties No. RV528MX or equal, 2 per insulator, to secure cable to cable hook and cable insulator.
- 7. Cable Duct Shields: Shields shall be provided where cables enter and leave box, and other duct entrances, and shall be suitable type manufactured for the purpose. All conduits shall have endbells.
 - 8. Provide 8" - 12" diameter sump in the bottom of the box with 18" deep clay tile pipe sump, with cast iron grate.
 - 9. Provide water tight sealing compound between each joint in the sections of the box.
 - 10. The minimum box necking height shall be not less than 24" high with a minimum of two (2) 6-inch high removable necking rings. Provide two galvanized step rungs and ladder rung retainers.
 - 11. Exterior walls and tops of structure shall be damp-proofed on the exterior face with two coats of bituminous damp-proofing.
 - 12. Provide ground rods in box.
 - 13. Interior wall shall be painted white in color with concrete paint.
 - 14. Acceptable manufacturers:
 - a. Brooks Products
 - b. Associated Concrete Products (Quickset)
 - c. Jensen
 - d. Or Equal.

I. Precast Concrete Handholes

- 1. Same requirements as precast concrete manholes.
 - a. Size as shown.

J. Cable Tags

1. Shall be 2" diameter, black anodized aluminum with 3/16" diameter hole. Lettering shall be 5/32" machine engraved and coated with clear lacquer. Include the following information:
 - a. Feeder designation and size.
 - b. Phase designation, tag "A," "B," or "C" as required.
 - c. Manufacturer's name.
 - d. System voltage.
 - e. Date cable first energized.

PART 3 - EXECUTION

3.01 WIRING METHOD

A. Wiring Method shall be as follows:

1. Exposed: Rigid steel conduit, unless otherwise indicated.
2. Concealed: Rigid steel conduit, unless otherwise indicated.
 - a. In or under slab on grade: Nonmetallic conduit, Schedule 40 PVC unless otherwise indicated. Conduit leaving the slab (including exposed conduit riser) shall be rigid steel conduit.
3. Underground, single run: Rigid nonmetallic conduit. Use Schedule 40 PVC unless otherwise indicated. Provide concrete encasement as indicated. Conduit leaving the slab (including exposed conduit riser) shall be rigid steel conduit.
4. Underground, grouped: Rigid nonmetallic conduit. Use Schedule 40 PVC unless otherwise indicated. Provide concrete encasement as indicated. Conduit leaving the slab (including exposed conduit riser) shall be rigid steel conduit.

3.02 INSTALLATION

A. Exercise care in excavating, trenching and working near existing utilities.

Trenching and Backfill:

1. Contractor shall trench underground duct path and manhole location with utmost care in order to avoid existing underground facilities. Trench size shall be kept to a minimum. No oversized trench shall be made unnecessarily.
2. All trench excavations by the Contractor shall be backfilled by same in accordance with this specification.
3. All material excavated during underground electrical work is not pre-qualified for

backfill.

4. All fill must be placed in layers not exceeding 8 inches in depth and hand tamped or machine compacted to at least 95 percent of its maximum dry density as computed by the ASTM method of performing a compaction test (D-1557-70).
5. All compacted fill will be under continuous inspection by the Inspector. Compaction tests will be arranged for by the Inspector in cooperation with the Contractor.
6. Puddling or water-flooding for settling backfill will not be permitted except in landscaped areas. The addition of water shall be limited to achieving optimum moisture content for tamp procedures.
7. Where Contractor trenches crosses any finished road (paved or gravel), he shall be responsible for restoring the road to its original condition. Repaving shall be with the same surrounding material and to a quality equal or exceeding its surround.
8. Do not backfill for a period of at least 24 hours after pouring concrete. Upon receipt of the Inspector's approval proceed with backfill. Backfill with 1 sack slump concrete and repair of surface to be completed within 24 hours of approval. Provide wet sand backfill in landscape areas.
9. Survey slope of trenches and ducts between terminations to provide drainage. No pockets shall be permitted.

B. Underground Duct with Concrete Encasement:

1. Underground ductbanks lines shall be constructed of individual conduits encased in concrete. Conduit shall be of Schedule 40 PVC. The kind of conduit used shall not be mixed in any one duct bank. PVC ducts shall not be smaller than 2 inches in diameter unless otherwise indicated. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete outer encasement for ducts. Conduit shall be separated by a minimum concrete thickness of 2 inches.
2. The top of the concrete envelope shall not be less than 36 inches below grade, except that under roads and pavement it shall be not less than 36 inches below grade.
3. Ductbanks shall have a continuous slope downward toward manholes with a pitch of not less than 1.5 inches in 100 feet. Except at conduit risers, changes in direction of runs exceeding a total of 10 degrees, either vertically or horizontally, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 24 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 48 inches for ducts of 3 inches in diameter and larger.

4. PVC conduits shall terminate in end-bells where duct lines enter pullboxes or manholes. Separators shall be of precast concrete, high-impact polystyrene, steel, or any combination of these. The joints of the conduits shall be staggered by rows and layers so as to provide a duct line having maximum strength.
5. During construction, partially completed duct lines shall be protected from the entrance of debris such as mud, sand, concrete and dirt by means of suitable conduit. As each section of a duct line is completed, a testing mandrel not less than 12 inches long with a diameter 1/4 inch less than the size of the conduit shall be drawn through each conduit, after which a brush having the diameter of the duct and having stiff bristles shall be drawn through the conduit until it is clear of all particles of earth, sand, or gravel. Conduit plugs shall then be immediately installed.
6. Locate spacers no greater than 5 ft. center to center, along entire length of ductbank.
7. Duct couplings may be placed side by side horizontally, but staggered at least 6 in. vertically.
8. Make conduit joints in accordance with manufacturer's recommendations. In the absence of specific recommendations, make the joints as follows:
 - a. Brush a plastic solvent cement on the inside of the coupling and on the outside of the duct ends.
 - b. Slip duct and fitting together with a quick one-quarter turn to set the joints.
9. Follow ductbank sections on the drawings for size, arrangement and spacing of ducts.
10. Secure ducts and spacers to prevent movement during placement of concrete.
11. At connection to existing manhole, dowel the concrete encasement with one #4 reinforcing bar 36 in. long per duct. (Minimum of two required.)
12. Concrete; in accordance with the following:
 - a. Provide #4 rebar dowels at each concrete joint/pour transition. A minimum of 8' long #4 rebar dowel, one (1) per conduit in ductbank.
 - b. Provide rebar and tie-downs to prevent conduits from floating to top of concrete during curing.
 - c. Make ductbank construction monolithic top to bottom and side to side.
 - d. Do not exceed the outside dimension of the completed ductbank by more than 1 inch in the vertical or 4 inches in the horizontal from dimensions indicated.

- e. Use plastic film to retain moisture for proper curing.
- 13. Ductbank concrete may be poured without forming, provided trench walls are firm and will not cave in during installation. Unless noted otherwise, encase the raceway on all sides with a minimum of 3 inches of concrete.
- 14. Where conduits are stubbed out for future connection, stop concrete 12 inches from end of conduit. Provide a waterproof cap on the end of the conduit.
- 15. The top of the concrete ductbank shall be as shown on the drawings, or as otherwise required by code and as required to coordinate with other underground obstructions.

C. Connections to Existing Ducts

- 1. Where connections to existing duct lines are indicated, excavate the lines to the maximum depth necessary. Cut off the lines and remove loose concrete from the conduits before installing new concrete encased ducts. Provide a reinforced concrete collar, poured monolithically with the new duct line, to take the shear at the joint of the duct lines. Remove existing cables which constitute interference with the work.

D. Connections to New Handholes and Manholes

- 1. Construct concrete-encased duct lines connecting to underground structures to have a flared section adjacent to the handhole or manhole to provide shear strength. Construct underground structures to provide for keying the concrete encasement of the duct line into the wall of the structure. Use vibrators when this portion of the encasement is poured to ensure a seal between the encasement and the wall of the structure.

E. Connection to Existing Handholes and Manholes

- 1. For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and bend out to tie into the reinforcing of the duct line encasement. Chip out the structure wall to form a key for the duct line encasement.

F. Connections to Existing Concrete Pads

- 1. For duct line connections to concrete pads break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and bend out to tie into the reinforcing of the duct line encasement. Chip out the opening in the pad to form a key for the duct line encasement.

G. Removal of Ducts

1. Where duct lines are removed from existing manholes, close openings and waterproof manhole. Chip out the wall opening to provide a key for the new section of wall.

H. Precast manholes, handholes, and pullboxes shall be of sizes required.

1. Manholes and handholes:

- a. Precast concrete assembly shall be set on 6 inches of level, 95 percent compacted, crushed rock fill, 3/4" to 1" size, extending 12" beyond the manhole on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator. Drain line and accessories shall be installed as indicated.
- b. Excavate, backfill, and compact in accordance with Section 022XX. Utilize dirt removed to level and restore landscape a minimum of 6 feet around box.
- c. Seal section joints with sealing compound furnished by the manufacturer.
- d. Apply two coats of asphalt paint to cover frames.
- e. Provide two 3/4" diameter x 10" long copper-clad driven ground rods at opposite corners of manholes and handholes with #2/0 AWG bare copper ground wire interconnecting all non-current carrying metal components in manhole or handhole with compression type ground fittings at each connection point.
- f. Ground all cable racks, supports, metal conduits and ductbank grounding conductors to the driven grounding electrode.
- g. Restore landscape to original condition.
- h. Place duct and conduit entries not less than 24" above floor. Provide end bells at all duct entrances. Terminate each metal conduit with insulated bushing having grounding terminal.
- i. Place pulling irons on opposite walls and below horizontal centerlines of duct openings, and in bottom directly below cover. Install pulling irons with each end hooked around a reinforcing bar.
- j. Dampproof exterior walls and tops of structure below grade with two coats of bituminous coating. Use A.C. Horn Company "Dehydratine" No. 4, Sonneborn Sons, Inc. "Hydrocide 648," Toch Brothers "RIW Marine Cement Semi-Mastic," or equal.
- k. Identify all power and signal cables by tagging in all manholes. Tie securely to cables with nylon cord.
- l. Install cables in conformance with CEC requirements.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

1. PART 1 - GENERAL

1.1 SUMMARY

1.1.1. This Section includes:

1.1.1.1. Equipment labels and signs.

1.1.1.2. Identification labeling for raceways, cables, and conductors.

1.1.1.3. Buried electrical line warnings.

1.1.1.4. Warning and caution signs

1.1.1.5. Operational instruction signs.

1.1.2. Electrical identification requirements in this Section may be supplemented in other sections of these specifications.

1.1.3. Related Sections:

1.1.3.1 General electrical requirements: Section 26 05 01.

1.1.3.1.1. Painting: Section 099100.

1.1.3.2. Color coding of conductors for phase identification: Section 26 05 19.

1.1.3.3. Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

1.2 REFERENCES

1.2.1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

1.2.2. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1.2.2.1. ANSI American National Standards Institute.

1.2.2.2. ASTM American Society for Testing and Materials.

1.2.2.3. IEEE Institute of Electrical and Electronics Engineers.

1.2.2.4. CEC California Electrical Code.

1.2.2.5. NEMA National Electrical Manufacturers Association.

1.2.2.6. NFPA National Fire Protection Association

1.2.2.7. UL Underwriters Laboratories, Inc.

1.3 SUBMITTALS

- 1.3.1.** In addition to this Section, the submittal requirements of Section 260501, "General Electrical Requirements" are applicable.
- 1.3.2.** Product Data: Provide catalog data for nameplates, labels, and markers.
- 1.3.3.** Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.4 REGULATORY REQUIREMENTS

- 1.4.1.** Conform to requirements of CEC.
- 1.4.2.** Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.5 PROJECT RECORD DOCUMENTS

- 1.5.1.** Accurately record actual labeling and identification of electrical equipment, components, and wiring.

1.6 QUALITY ASSURANCE

- 1.6.1.** Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.
- 1.6.2.** Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code."
- 1.6.3.** NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.
- 1.6.4.** NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."
- 1.6.5.** Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.7 DELIVERY, STORAGE AND HANDLING

- 1.7.1.** General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- 1.7.2.** Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.8 PROJECT CONDITIONS OR SITE CONDITIONS

- 1.8.1.** Verify that field measurements are as shown prior to commencing the work.

2. PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 2.1.1.** Subject to compliance with requirements, provide products by the following:

- 2.1.1.1. Brady
- 2.1.1.2. Ideal Industries
- 2.1.1.3. Markal
- 2.1.1.4. Panduit
- 2.1.1.5. Thomas & Betts

2.2 ELECTRICAL IDENTIFICATION PRODUCTS

- 2.2.1. Adhesive Marking Labels for Raceway and Metal-clad Cable: Pre- printed, flexible, self-adhesive labels with legend indicating voltage and service (Emergency, Power, Lighting, Air Conditioning, Voice and Data Communications, Control, Fire Alarm and Detection, Public Address (Paging), Electronic Security).
- 2.2.2. Label Size, as follows:
 - 2.2.2.1. Raceways 1-Inch and Smaller: 1-1/8 inches high by 4 inches long.
 - 2.2.2.2. Raceways Larger than 1-Inch: 1-1/8 inches high by 8 inches long.
- 2.2.3. Color: Black legend on orange background.
- 2.2.4. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.
- 2.2.5. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Raceway and Cable Identification: Flexible acrylic bands sized to suit the raceway diameter and arranged to stay in place by pre- tensioned gripping action when coiled around the raceway or cable.
- 2.2.6. Underground Line Marking Tape: Permanent, bright-colored, continuous-printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.
- 2.2.7. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self- adhesive, wraparound, cable/conductor markers with Preprinted numbers and letter.
- 2.2.8. Aluminum, Wraparound, Cable Marker Bands: Bands cut from 0.014- inch thick, aluminum sheet, fitted with slots or ears for securing permanently around wire or cable jacket or around groups of conductors. Provide for legend application with stamped letters or numbers.
- 2.2.9. Plasticized Card Stock Tags: Vinyl cloth with preprinted and field-printed legends to suit the application. Orange background, except as otherwise indicated, with eyelet for fastener.
- 2.2.10. Aluminum-Faced Card Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inches thick, and laminated with moisture-resistant acrylic adhesive. Pre-print legend to suit the application, and punch for tie fastener.
- 2.2.11. Brass or Aluminum Tags: Metal tags with tamped legend, punched for fastener. Dimensions: 2 inches by 2 inches by 19 gauge.
- 2.2.12. Engraved, plastic-laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letter on black face and punched for mechanical fasteners.

- 2.2.13.** Warning and caution signs for indoor use: Shall be minimum 18 gauge steel, white porcelain enamel finish, with red lettering, punched for fasteners, with colors, legend, and size appropriate to the location. Lettering to read, "DANGER - HIGH VOLTAGE - KEEP OUT," unless otherwise indicated.
- 2.2.14.** Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, nonfading, preprinted cellulose acetate butyrate signs with 20-gauge, galvanized steel backing, with colors, legend, and size appropriate to the location. Provide 1/4-inch grommets in corners for mounting.
- 2.2.15.** Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.
- 2.2.16.** Cable Ties: Fungus-inert, self-extinguishing, one-piece, self- locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50 deg F to 350 deg F. Provide ties in specified colors when used for color coding.

3. PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1. General:

- 3.1.1.1.** Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- 3.1.1.2.** Install identification devices in accordance with manufacturer's written instructions and requirements of CEC.
- 3.1.1.3.** Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

3.1.2. Identify electrical equipment and enclosures, including but not limited to the following::

3.1.2.1. General

- 3.1.2.1.1** Switchgear and switchboards
- 3.1.2.1.2.** Panelboards
- 3.1.2.1.3.** Enclosed switches
- 3.1.2.1.4.** Transfer switches
- 3.1.2.1.5.** Enclosed motor controllers
- 3.1.2.1.6.** Control devices, such as pushbutton- or rotary-selection stations
- 3.1.2.1.7.** Motor control centers
- 3.1.2.1.8.** Substations and transformers
- 3.1.2.1.9.** Contactors
- 3.1.2.1.10.** Lighting system relay cabinets
- 3.1.2.1.11.** Dimming controls
- 3.1.2.1.12.** Power supplies, inverters, and rectifiers
- 3.1.2.1.13.** Pull-, junction-, and splice-boxes
- 3.1.2.1.14.** Terminal boxes and cabinets
- 3.1.2.1.15.** Access doors and panels for concealed electrical items

3.1.3. Identify underground electrical lines:

3.1.4. Identify electrical circuits:

- 3.1.5.** Identify conduit containing circuit wiring operating at over 600 volts:
- 3.1.5.1.** State "DANGER - HIGH VOLTAGE" in black letters 2-inches high, stenciled at 10-foot intervals over a continuous-painted orange background.
 - 3.1.5.2.** In addition, the following areas shall be identified:
 - 3.1.5.2.1.** The entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above an unexcavated space.
 - 3.1.5.2.2.** On wall surfaces directly external to conduits run concealed within wall.
 - 3.1.5.2.3.** On all accessible surfaces of concrete envelope around conduits in vertical shafts, exposed at ceilings, or concealed above suspended ceilings.
 - 3.1.5.2.4.** On entire surface of exposed conduits.
 - 3.1.6.** Identify Junction, Pull, and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuit. Use pressure-sensitive plastic labels at exposed location and similar labels or plasticized card stock tags at concealed boxes.
 - 3.1.7.** Underground Electrical Line Identification: During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple line installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.
 - 3.1.8.** Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductor throughout the project secondary electrical system as follows:

<u>208/120 Volts</u>	<u>Phase</u>	<u>480/277 Volts</u>
Black	A	Yellow
Red	B	Brown
Blue	C	Orange
White	Neutral	Gray
Green	Ground	Green
 - 3.1.9.** Use conductors with color factory-applied the entire length of the conductors except as follow:
 - 3.1.9.1.** The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
 - 3.1.9.1.1.** Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two lap of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
 - 3.1.9.1.2.** In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the

terminal and paced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

- 3.1.10.** Power Circuit Identification: Securely fasten identifying metal tags or aluminum wraparound marker bands to cables, feeders, and power circuit in vault, pull boxes, junction boxes, manhole, and switchboard rooms with 1/4-inch steel letter and number tamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-lb test monofilament line or one-piece self-locking nylon cable ties.
- 3.1.11.** Tag or label conductors as follows:
 - 3.1.11.1** Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
 - 3.1.11.2.** Multiple Circuits: Where multiple branch circuits or control wiring or communications / signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home run) label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by means of coded color of conductor insulation. For control and communication / signal wiring, use color coding or wire / cable marking tape at termination and at intermediate location where conductors appear in wiring boxes, troughs, and control cabinet. Use consistent letter / number conductor designation throughout on wire / cable marking tape.
 - 3.1.11.3.** Match identification markings with designations used in panelboards, shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installation.
- 3.1.12.** Apply warning, caution, and instruction signs and stencils as follows:
 - 3.1.12.1.** Install warning, caution, or instruction signs where required by CEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic laminated instruction signs with approved legend where instruction or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
 - 3.1.12.1.2.** In addition to the above:
 - 3.1.12.1.1.** Warning signs shall be included on door, or immediately above door, of all electrical equipment rooms, or closets containing equipment energized above 150 volts to ground.
 - 3.1.12.1.2.** Warning designations in 1-inch high red letters shall be painted by stencil, or applied with pre-printed adhesive labels, on each pullbox, cabinet, or 10-foot length of exposed raceway stating: "DANGER-KEEP OUT," and stating the voltage of the enclosed conductors (for example, "480 VOLTS"), for all systems of over 150 volts to ground.
 - 3.1.12.3.** Emergency Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instruction on power transfer, load shedding, or other emergency operations.
 - 3.1.12.4.** Permanently mount signs with cadmium plated steel screws or nickel-plated brass bolts.
- 3.1.13.** Install equipment/system circuit/device identification as follows:

3.1.13.1. Apply equipment identification labels of engraved plastic-laminate (fastened with self-tapping or threaded screws) on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with a minimum of 1/4-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), white lettering in black field. Adhesive letters are not acceptable. Text shall match terminology and numbering shown, if provided. For emergency systems, the background field shall be red and include the word, "EMERGENCY." Apply label for each unit of the following categories of electrical equipment:

3.1.13.1.1. Panelboards, electrical cabinets, and enclosures.

3.1.13.1.2. Access doors and panels for concealed electrical items.

3.1.13.1.3. Electrical switchgear and switchboards.

3.1.13.1.3.1. State rating, including voltage, continuous current, horsepower or maximum current switching.

3.1.13.1.3.2. For enclosed circuit breakers, state voltage, continuous current, maximum interrupting current and trip current.

3.1.13.1.3.3. If fused with current-limiting protective devices, include nameplate stating: "Fuses Must Be Replaced With Current Limiting Type of Identical Characteristics."

3.1.13.1.4. Electrical substations.

3.1.13.1.5. Motor control centers.

3.1.13.1.6. Motor controllers.

3.1.13.1.6.1. Include voltage, current, horsepower, and trip setting of motor running overcurrent protection.

3.1.13.1.7. Pushbutton stations.

3.1.13.1.8. Power transfer equipment.

3.1.13.1.8.1. For transfer switches, include voltage, current and interrupting or withstand current.

3.1.13.1.9. Contactors.

3.1.13.1.9.1. Include voltage, continuous current, horsepower or interrupting current, and whether "mechanically-held" or "electrically-held."

3.1.13.1.10. Remote-controlled switches.

3.1.13.1.11. Dimmers.

3.1.13.1.12. Control devices.

3.1.13.1.13. Transformers.

3.1.13.1.14. Inverters.

3.1.13.1.15. Rectifiers.

3.1.13.1.16. Lighting system relay cabinets.

3.1.13.1.17. Battery racks.

3.1.13.1.18. Power generating units.

3.1.13.1.19. Telephone switching equipment.

3.1.13.1.20. Clock/program master equipment.

3.1.13.1.21. Fire alarm master station or control panel, annunciators.

3.1.13.1.22. Security monitoring master station or control panel.

3.1.14. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm / signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

3.1.15. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

END OF SECTION

SECTION 260573
PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Short Circuit Studies, Protective Device Evaluation Studies, and Protective Device Coordination Studies shall be provided by the switchboard/switchgear manufacturer. The studies shall be submitted to the Engineer prior to receiving final approval of the distribution equipment shop drawings and / or prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval from the Engineer may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.
- B. The studies shall include all portions of the electrical distribution system from the normal and emergency power source or sources down to and including the 12kV, 480V and 208V distribution system. Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.
- C. The Short Circuit Study shall be in accordance with the latest revisions of ANSI C37.5, IEEE Std. 399 and IEEE Std. 141.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Submittals: Sections 260501 and Division 1 specifications.

1.03 SHORT CIRCUIT STUDY

- A. The study input data shall include the power company's short circuit contribution, resistance and reactance components of the branch impedances, the X/R ratios, base quantities selected, and other source impedances.
- B. Short circuit momentary duty values and interrupting duty values shall be calculated on the basis of assumed three-phase bolted short circuits at each switchgear bus, medium voltage controller, switchboard, low voltage motor control center, distribution panelboards, pertinent branch circuit panel, and other significant locations through the system. The short circuit tabulations shall include symmetrical fault currents, and X/R ratios. For each fault locations, the total duty on the bus, as well as the individual contribution from each connected branch, shall be listed with its respective X/R ratio.

1.04 PROTECTIVE DEVICE EVALUATION STUDY

- A. A protective device evaluation study shall be performed to determine the adequacy of circuit breakers, molded case switches, automatic transfer switches, and fuses by tabulating and

comparing the short circuit ratings of these devices with the calculated fault current. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied. Any problem areas or inadequacies in the equipment due to short circuit currents shall be promptly brought to the Engineer's attention.

1.05 PROTECTIVE DEVICE COORDINATION STUDY

- A. A protective device coordination study shall be performed to provide the necessary calculations and logic decisions required to select or to check the selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. The objective of the study is to obtain optimum protective and coordination performance from these devices.
- B. The coordination study shall include all medium and low voltage classes of equipment from the utility's incoming line protective device down to and including the largest rated device in the 480 volt MCC and panelboard. The phase and ground overcurrent protection shall be included, as well as settings of all other adjustable protective devices.
- C. The time-current characteristics of the specified protective devices shall be drawn on log-log paper. The plots shall include complete titles, representative one-line diagram and legends, associated power company's relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating banks of low voltage circuit breaker trip curves and fuses. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits and significant symmetrical and asymmetrical fault currents. All restrictions of the National Electrical Code shall be adhered to and proper coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a system basis. A sufficient number of separate curves shall be used to clearly indicate the coordination achieved.
- D. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connections, manufacturer and type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for the medium voltage fuses where applied in the system. Any discrepancies, problem areas, or inadequacies shall be promptly brought to the Engineer's attention.

1.06 STUDY REPORT

- A. The results of the power system study shall be summarized in a final report. Final report shall be submitted in electronic pdf formats.
- B. The report shall include the following sections:

1. Description, purpose, basis and scope of the study and a single line diagram of that portion of the power system which is included within the scope of the study.
2. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
3. Protective device time versus current coordination curves, tabulations of relay and circuit breakers trip settings, fuse selection, and commentary regarding same.
4. Fault current calculations including a definition of terms and guide for interpretation of computer printout.

1.07 PROTECTIVE DEVICE TESTING, CALIBRATION AND ADJUSTMENT

- A. The equipment manufacturer shall provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate and adjust the protective relays and circuit breaker trip devices as recommended in the power system study.

END OF SECTION

SECTION 262213
LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section Includes:

1. Dry type transformers.

B. Related Sections:

1. General electrical requirements: Section 260501.

1.02 REFERENCES

- A. Drawings and general provisions of the Contract, including General- and Supplementary-Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 16.

- B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1. American National Standards Institute

ANSI/IEEE C57.12.80 Terminology for Power and Distribution Transformers

2. ASTM American Society for Testing and Materials
3. IEEE Institute of Electrical and Electronics Engineers
4. CEC California Electrical Code (CEC)
5. NECA National Electrical Contractors Association "Standard of Installation"
6. National Electrical Manufacturers Association

NEMA ST 1 Specialty Transformers

NEMA ST 20 Dry Type Transformers for General Applications

NEMA TP 1 Guide for Determining Energy Efficiency for Distribution Transformers

NEMA TP 2 Standard Test Method for Measuring the Energy Consumption of Distribution Transformers

7. NFPA National Fire Protection Association
8. Underwriters Laboratories, Inc.

UL 486A Wire Connectors and Wiring Lugs for Use with Copper Conductors

UL 486B Wire Connectors for Use with Aluminum Conductors

1.03 SUBMITTALS

- A. General: Submit the following in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Shop Drawings and Product Data: Submit for each type of product specified. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap and winding configurations, sound level characteristics, insulation system type, and rated temperature rise.
 - 1. Submit test reports with loss data, efficiency at 25/50/75/100 percent rated load, and sound level.
- C. Operating, Maintenance, and Instructional Data: Manufacturers' written operating, maintenance, and installation instructions, including directions for storage and protection, handling, examination, and preparation.
 - 1. In addition, include copies of this data in Operating and Maintenance Manuals submitted, see Section 260501.
- D. Certificates:
 - 1. Labels of UL listing, fixed to each item of material.
 - 2. Product test reports, including certified copies of manufacturer's design and routine (production) factory tests required by the referenced standards.

1.04 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.
- B. Electrical Component Standard: Components and installation shall comply with CEC, "California Electrical Code."
- C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.
- D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation".
- E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.06 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown prior to commencing the work.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General Electric Co.
- B. International Transformer Co.
- C. Square "D".
- D. Cutler-Hammer.
- E. Siemens

2.02 MATERIALS

- A. Description: ANSI/NEMA ST 20; factory-assembled, air-cooled dry type energy efficient transformers; ratings as shown on Drawings. Transformer shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accordance with NEMA TP2. Transformer shall be marked with the Energy Star label.

SINGLE PHASE		THREE PHASE	
<u>KVA</u>	<u>Efficiency</u>	<u>KVA</u>	<u>Efficiency</u>
15	97.7%	15	97.0%
25	98.0%	30	97.5%
37.5	98.2%	45	97.7%
50	98.3%	75	98.0%
75	98.5%	112.5	98.2%
100	98.6%	150	98.3%
167	98.7%	225	98.5%
250	98.8%	300	98.6%
333	98.9%	500	98.7%
750	98.8%		

- B. Insulation system and average winding temperature rise for rated kVA as follows:
 1. 1-15 kVA: NEMA Class 185 with 115 degrees C rise.
 2. 16-500 kVA: NEMA Class 220 with 150 degrees C rise.

C. Case temperature: Do not exceed 40 degrees C (maximum) and 30 degrees C (average) rise above ambient at warmest point at full load.

D. Winding Tape:

1. Transformers less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
2. Transformer 15 kVA and larger; four 2-1/2 percent FCBN tapes and 2 above.

E. Sound Levels: Maximum sound levels are as follows:

<u>KVA Rating</u>	<u>Sound Level</u>
15	45db
30	45db
45	45db
75	50db
112.5	50db
150	50db
225	55db
300	55db
500	60db

F. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30kV for transformers 300 kVA and larger.

G. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

H. Mounting:

1. 1-15 kVA: Suitable for wall mounting.
2. 16-75 kVA: Suitable for wall, floor, or trapeze mounting.
3. Larger than 75 kVA: Suitable for floor, or trapeze mounting.

I. Coil Conductors: Continuous aluminum (unless otherwise shown) windings with termination brazed or welded.

J. Enclosure: NEMA ST 20, Type 1 or 3R, ventilated, as indicated on the Drawings. Provide lifting eyes or brackets.

K. Isolate core and coil from enclosure using vibrating-absorbing mounts.

L. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Secure floor mounted transformers to floor with bolts.
- B. Set transformers plumb and level.
- C. Install transformer ventilation openings not closer than 6 inches from any wall surface, or as indicated in the manufacturer's installation manual when greater distances are required.

3.02 VOLTAGE ADJUSTMENT

- A. When final connection has been made, check secondary voltage at dry type transformers and make tap adjustments required to obtain correct voltage.

3.03 VIBRATION ISOLATION

- A. Provide isolation procedures described below in addition to those provided by the transformer manufacturer:

- 1. For floor or roof transformer installation, use pad type vibration isolators, Korfund Elasto-Grip, waffle, or equal, sized to load 50 pounds per square inch. Install one at each corner of the transformer.
- 2. For wall hung transformer installations, use pad type vibration isolators, Korfund Elasto-Grip, waffle, or equal, sized to load 50 pounds per square inch. Locate pads between hanger and wall.

NOTE: Normally, use above isolation. However, on critical projects, springs-type isolation as described below may be required.

- 3. Use steel spring type Korfund Series "P", sized for 1/2" deflection with consideration to the weight of the transformer, installed at each corner.
- 4. Install spring type isolators on both floor mounted transformers and transformers hung from structure such that vibration is not transmitted to the building structure.

3.04 CONNECTIONS

- A. Provide solderless lug bonding connection on the inside of the transformer enclosure in accordance with NEC.
- B. Make primary and secondary connections with liquid tight flexible metal conduit to prevent transformer vibration from being transferred to the building structure of conduit system.

END OF SECTION

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SECTION 262413 SWITCHBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section Includes:

1. Distribution switchboards, front-accessible, indoor-type, rated 600 volts and below.

B. Related Sections:

1. General electrical requirements: Section 260501.

1.02 REFERENCES

- A. Drawings and general provisions of the Contract, including General- and Supplementary-Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

- B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1. American National Standards Institute

ANSI C12 Code for Electricity Metering
ANSI C39.1 Electrical Analog Indicating Instruments
ANSI C57.13 Requirements for Instrument Transformers

2. ASTM American Society for Testing and Materials
3. IEEE Institute of Electrical and Electronics Engineers
4. CEC California Electrical Code (CEC)
5. NECA National Electrical Contractors Association "Standard of Installation"
6. National Electrical Manufacturers Association

NEMA AB 1 Molded Case Circuit Breakers
NEMA KS 1 Enclosed and Miscellaneous Equipment Switches (600 Volts Maximum)
NEMA PB 2 Dead Front Distribution Switchboards
NEMA PB 2.1 General Instructions for Proper Handling, Installation, Operation, and Maintenance of Dead front Switchboards Rated 600 Volts or Less
NEMA 260 Safety Labels for Pad mounted Switchgear and Transformers Sited in Public Areas

7. NFPA National Fire Protection Association
8. Underwriters Laboratories, Inc.

UL 486A Wire Connectors and Wiring Lugs for Use with Copper Conductors
UL 486B Wire Connectors for Use with Aluminum Conductors
UL 891 Deadfront Electrical Switchboards

1.03 SUBMITTALS

- A. General: Submit the following in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Shop Drawings: Include layouts showing cabinet dimensions, conduit entrances, electrical ratings, bussing connections, single line diagrams, device locations and ratings, and cable termination provisions.
- C. Product Data: Submit for each type of product specified.
- D. Operating, Maintenance, and Instructional Data: Manufacturers' written operating, maintenance, and installation instructions, including directions for storage and protection, handling, examination, and preparation.
 1. In addition, include copies of this data in Operating and Maintenance Manuals submitted, see Section 260501.
- E. Samples: Provide samples upon specific request.
- F. Certificates:
 1. Labels of UL listing, fixed to each item of material.
 - a. Label of UL listing for service entrance use, where applicable, affixed to material.

1.04 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.
- B. Electrical Component Standard: Components and installation shall comply with CEC, "California Electrical Code."
- C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.

- D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."
- E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.06 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown prior to commencing the work.

1.07 EXTRA MATERIALS

- A. Furnish 3 of each type and size of fuse installed.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Siemens
- B. General Electric
- C. Square D
- D. Cutler-Hammer

2.02 MATERIALS

- A. Main Switchboard:
 - 1. Furnish and install a totally enclosed, dead front, safety type switchboard designed for voltage and service ampacity as indicated on drawings and mounted on 6" thick minimum concrete pad. Refer to drawings for mounting detail(s).
- B. Provide a switchboard consisting of the required number of vertical sections bolted together to form one metal enclosed, rigid switchboard with the following features:

1. The sides, top and rear covered with removable screw-on code gauge steel plates.
 2. Include all protective devices and equipment as listed on drawings with necessary interconnections.
 3. Silver or tin plated copper bus.
 4. Bus bars mounted on supports of high impact nontracking insulation material braced to withstand mechanical forces exerted during 100,000 amp RMS symmetrical short circuit conditions, or as required by serving utility.
- C. Chemically clean steel surfaces and treat to aid bonding between paint and metal surfaces. Provide high tensile strength hardware on conductors and suitable protective finish.
- D. Provide full length copper ground bus. Secure a ground bus to each vertical section of structures and extend it the entire length of the switchboard.
- E. Provide switchboard with adequate lifting means, capable of being rolled or moved into installation position and bolted directly to the floor without the use of floor sills.
- F. Use A-B-C type bus arrangement - left-to-right, top-to-bottom and front-to-rear throughout. Switchboard shall be entirely accessible from the front, including cable and bus connections, unless specifically noted otherwise.
- G. Provide group mounted, quick-break protective devices with bar connection straps, with device line and load connections accessible from the front. Where "spaces" are scheduled furnish entire bus except device connecting straps. Provide full height wiring gutter covers for quick access to wiring terminals.
- H. The switchboard framework shall be made of formed steel angles securely bolted or riveted together. Adjacent to each switch unit provide a lamacoid plastic name plate engraved with proper circuit designation, screw-on type only.
- I. At top of switchboard and supported on the frame, there shall be provided a pull box for termination of the conduits to the board. It shall not be less than 18" in height and shall be built as an integral part of the switchboard. The front of the pull box shall be removable and the bottom shall consist of ebonized asbestos panels drilled for cables and bussing. The entire exterior of the switchboard and pull box enclosures shall be painted with prime coat and finished smooth with 2 coats of gray enamel, ASA 33.
- J. Switches over 600 ampere capacity shall be bolted pressure contact type of capacity and number of poles indicated and equipped with Bussmann Hi-Cap, current limiting fuses only.
- K. Switches 600 ampere and below shall be quick-make, quick-break of capacity and

number of poles indicated.

- L. Switches 600 amperes and below shall be equipped with rejection type fuse clips to accept only high-capacity type fuses. Furnish current limiting type fuses.
- M. Main busses shall be silver- or tin-plated copper sized on the basis of a current density to hold temperature rise to 50 degrees C above 40 degrees C ambient. The bus structure shall be braced to withstand the mechanical forces exerted during a fault as shown on the drawings.
- N. The switchboard shall bear the label of approval of the Underwriter's Laboratories and shall be built to NEMA and IEEE standards. Seven copies of shop drawings of the proposed board shall be furnished to comply with these specifications.
- O. Circuit breakers:
 - 1. Resettable, quick-make, quick-break, bolt-in place type, trip-free, with separate trip position from on and of positions.
 - 2. Multiple pole breakers with common trip and one operation handle.
 - 3. Do not provide handle ties.
 - 4. Wire with sequence phasing.
- P. Furnish record drawings providing the following information:
 - 1. Complete rating.
 - 2. Short circuit withstand-ability of bus and Lowest rated device.
 - 3. Overall outline dimensions including space available for conduits.
 - 4. Circuit schedule showing circuit number
 - 5. Device description
 - 6. Feeder circuit identification
 - 7. Conductor ratings and one-line diagram with each circuit device numbered.
- Q. Provide switchboards meeting U.L. Standard #UL891 and NEMA Standard PB-2. The U.L. label shall appear on all switchboard sections which contain U.L. listed devices.
- R. Provide ground fault protection on each main devices, rated 480/277 ground wye, 1,000 amps or larger, as follows:

1. U.L. listed ground sensor relay system equal to General Electric GSR. Provide ground break components for each system with coordinated ground sensor (CR) and integral test winding. Provide with solid state relay to operate shunt trip circuit on the switch and monitor panel.
 2. Use time relay with the following features:
 - a. Continuously adjustable current pick-up settings of 100 to 1,200 amperes.
 - b. Continuously adjustable time delay setting from instantaneous (.03 seconds) to one second.
 - c. Memory function to recognize and initiate tripping on intermittent ground faults.
 3. Install panel which:
 - a. Indicates relay operation.
 - b. Provides means for testing the system with or without interruption of electrical service.
 - c. Does not permit the ground fault system to be inadvertently left in an inactive or "off" state.
 4. Use ground sensor for zero sequence arrangement on the main service entrance devices.
- S. Provisions for padlocking the circuit breakers or disconnect in the "on" and "off" positions.
- T. Provide full rated bussing (no cascading).

PART 3 - EXECUTION

3.01 PREPARATION

- A. Carefully measure and lay out exact locations of switchboards in conference with Owner.
- B. Assure that panelboards may be installed without adversely affecting the integrity and appearance of the building structure and with the clearances required by the National Electrical Code.

3.02 INSTALLATION

- A. Install switchboard sections plumb and in straight horizontal alignment, securely fasten to

one another, and anchor to floor slab with adequate concrete inserts. Reference drawings for anchorage details.

- B. Install distribution switchboards on concrete foundations in accordance with other sections of the specifications.
- C. Terminate service and feeder conduits only in the switchboard section containing the lugs or device to which they are to be connected.
- D. Provide switchboards of the types and ratings scheduled where indicated.
- E. Provide supports to the building structure, independent of raceways.
Contractor shall be responsible for anchors and connections of electrical work to building structure to prevent damage as a result of earthquake, including the connection and integrity of field-fabricated materials and equipment. All building connections therefore shall be designed to resist seismic forces in conformance with Title 24 of the California Administrative Code.

Contractor shall submit shop drawings sealed by a Structural Engineer registered in the State of California to demonstrate compliance with the following requirement:

a. Component Anchorage Requirements:

- 1) All mechanical, plumbing, and electrical components shall be anchored and installed per the details on the DSA approved construction documents. Where no detail is indicated, the following components shall be anchored or braced to meet the force and displacement requirements prescribed in the 2022 CBC. Sections 1616A.1.18 through 1616A.1.26 and ASCE 7-16 Chapter 13, 26 and 30:
 - a) All permanent equipment and components.
 - b) Temporary or movable equipment that is permanently attached (e.g. hard wired) to the building utility services such as electricity, gas or water shall include electrical connections except plugs for 110.220 volt receptacles having flexible cable.
 - c) Temporary, movable or movable equipment which is heavier than 400 pounds or has a center mass located 4 feet or more above the adjacent floor or roof level that directly support the components is required to be restrained in a manner approved by DSA.
- 2) The following mechanical and electrical components shall be positively attached to the structure but need not demonstrate design compliance with the references noted above. These components shall have flexible connections provided between the component and the associated ductwork, piping and

conduit flexible connections must allow movement in both transverse and longitudinal directions.

- a) Components weighing less than 400 pounds and have a center of mass located 4 feet or less above the adjacent floor or roof level that directly support the component.
- b) Components weighing less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.

b. Piping, Ductwork, and Electrical Distribution System Bracing requirements:

- 1) Piping, ductwork, and electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7 Section 13.3 as defined in ASCE 7 Section 13.6.5, 13.6.6, 13.6.7 and 13.6.8; and 2022 CBC, Section 1617A.1.24, 1617A.1.25 and 1617A.1.26.
- 2) The method of showing bracing and attachments to the structure of the identified distribution system are as noted below. The MEP design professional engineer responsible for content on these sheets has verified that the design methods identified below are in accordance with DSA IR 16-13.
- 3) Mechanical piping (MP), mechanical ducts (MD), plumbing piping (PP), electrical distribution systems (E):
- 4) Option 1: Project-Specific Design
- 5) Option 2: Design based on OSHPD OPM, within project submittal
- 6) Option 3: Design based on OSHPD OPM, deferred submittal.

F. Install switchboards so that highest disconnecting breaker or switch handle is at a maximum of 6 feet 6 inches above finished floor.

G. Provide identification:

- 1. For switchboard circuits: Engraved, lamacoid plastic nameplate, white with black letters, giving circuit numbers and equipment identification.
- 2. All nameplates to be stainless steel screw-on types, no cement.

H. The anchorage of motor and circuit disconnects required for elevator drives, emergency generator, emergency motor loads, fire pumps and emergency lighting shall be designed in accordance with 2022 CBC Section 1613A and ASCE 7-16 Chapter 13.

3.03 FIELD QUALITY CONTROL

- A. Perform manufacturer's recommended field test prior to energization.
- B. Provide copies of test results to Owner.

3.04 LABELING AND IDENTIFICATION

- A. Provide engraved plastic nameplates on all switchboards not shown as exiting on the single line diagram, unless otherwise noted.
- B. Provide equipment and circuit designation on nameplates with minimum letter and plate sizes as indicated.
- C. Provide engraved plastic nameplates with 1/4-inch minimum height letters indicating circuit designation at branch overcurrent devices in switchboards.
- D. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section Includes:

1. Branch circuit and distribution panelboards, both circuit breaker- and fused switch-type, rated 600 volts and below.

B. Related Sections:

1. General electrical requirements: Section 260501.

1.02 REFERENCES

- A. Drawings and general provisions of the Contract, including General- and Supplementary- Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

- B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1. ANSI American National Standards Institute
2. ASTM American Society for Testing and Materials
3. IEEE Institute of Electrical and Electronics Engineers
4. CEC California Electrical Code (CEC)
5. NECA National Electrical Contractors Association "Standard of Installation"
6. National Electrical Manufacturers Association

NEMA AB 1 Molded Case Circuit Breakers

NEMA ICS 2 Industrial Control Devices, Controllers, and Assemblies

NEMA PB 1 Panelboards

NEMA PB 1.1 Instructions for Safe Installation, Operation and Maintenance of
Panelboards Rated 600 Volts or Less

7. NFPA National Fire Protection Association
8. Underwriters Laboratories, Inc.

UL 50 Cabinets and Boxes

UL 67 Panelboards

1.03 SUBMITTALS

- A. General: Submit the following in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Shop Drawings: Include layouts showing cabinet dimensions, conduit entrances, electrical ratings, bussing connections, single line diagrams, device locations and ratings, and cable termination provisions.
- C. Product Data: Submit for each type of product specified.
- D. Operating, Maintenance, and Instructional Data: Manufacturers' written operating, maintenance, and installation instructions, including directions for storage and protection, handling, examination, and preparation.
 - 1. In addition, include copies of this data in Operating and Maintenance Manuals submitted, see Section 260501.
- E. Samples: Provide samples upon specific request.
- F. Certificates:
 - 1. Labels of UL listing, fixed to each item of material.
 - a. Label of UL listing for service entrance use, where applicable, affixed to material.

1.04 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.
- B. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code."
- C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.
- D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."
- E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501,

"General Electrical Requirements."

- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.06 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown prior to commencing the work.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Siemens
- B. General Electric
- C. Square D
- D. Cutler-Hammer

2.02 MATERIALS

- A. Branch circuit panelboards:

1. Provide factory assembled, enclosed panelboards in dead front cabinets, with doors, surfaced mounted or recessed as indicated, not less than 20" wide and 5-3/4" deep. Height will depend on the number of breakers and spaces.
2. Where a control compartment is indicated, provide an integral compartment with a separate hinged lockable door held with captive screws.
3. Provide feeder terminal lugs for both main lugs only and main breakers rated for use with copper or aluminum conductors.
4. Provide three phase, 4 wire, solid neutral design with sequence bussing, full capacity neutral and full length copper bussing including areas indicated as space only. Bussing shall be braced for maximum available fault.
5. Provide copper neutral bus where neutral bus is indicated. Neutral bus shall be sized for minimum twice the current carrying capacity of line bus.
6. Key all door locks alike. Provide a type written directory of circuit index card holder mounted behind the door in framed card slot with plastic see through window.
7. Provide full-size copper equipment ground bus.
8. All breakers shall be bolt-on type molded case. No tie handle is accepted for multi-pole breaker.

9. Provide pad lock off devices on all breakers serving appliances, motor operated equipment, HVAC equipment and other circuits as indicated on panel schedules.
10. 120/208V, 3 Phase, 4 Wire Panelboards: General Electric Co. type NLAB, Square D Co. type NQOB, or Cutler-Hammer type POW-R-LINE1.
11. 277/480V, 3 Phase, 4 Wire Panelboards: General Electric Co. type NHB, Square D Co. type NEHB, ITE, Inc. type NHB, Sylvania Co. type NH1B or Cutler-Hammer type POW-R-LINE2.
12. All equipment shall be listed to meet or exceed the available fault current indicated on drawings.
13. Provide main lugs only unless scheduled otherwise.
14. Construct in accordance with U.L. and NEMA Standards.

B. Distribution Panelboards:

1. Provide circuit breaker type distribution panelboards with fully rated copper bus, lockable molded case breakers for mains and feeders. Provide nameplates for all circuit breakers.
2. Busing shall be braced to withstand maximum available fault current indicated on drawings.
3. Provide copper neutral bus where indicated. Neutral bus shall be sized for minimum twice the current carrying capacity of line bus.
4. Provide full size copper ground bus adequate for number of grounded circuits.
5. General Electric Co. type NCP and type CCB, or Square D Co. types HCN and HCM, or Cutler-Hammer type POW-R-LINE3 and POW-R-LINE4B.

C. Circuit breakers:

1. Resettable, quick-make, quick-break, bolt-in place type, trip-free, with separate trip position from on and off positions.
2. Multiple pole breakers with common trip and one operation handle.
3. Do not provide handle ties.
4. Wire with sequence phasing.
5. Circuit breakers shall be rated to meet or exceed the available fault current indicated on drawings.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Carefully measure and lay out exact locations of panelboards in conference with Owner.
- B. Assure that panelboards may be installed without adversely affecting the integrity and appearance of the building structure and with the clearances required by the California Electrical Code.

3.02 INSTALLATION

- A. Provide panelboards of the types and ratings scheduled where indicated.
- B. Provide flush or surface mounted types where indicated and scheduled.
 - 1. Provide multi-section cabinets as required and scheduled.
 - 2. Provide 2 keys for each panelboard.
- C. Provide supports to the building structure, independent of raceways.

Contractor shall be responsible for anchors and connections of electrical work to building structure to prevent damage as a result of earthquake, including the connection and integrity of field-fabricated materials and equipment. All building connections therefore shall be designed to resist seismic forces in conformance with Title 24 of the California Administrative Code.

Contractor shall submit shop drawings sealed by a Structural Engineer registered in the State of California to demonstrate compliance with the following requirement:

- a. Component Anchorage Requirements:
 - 1) All mechanical, plumbing, and electrical components shall be anchored and installed per the details on the DSA approved construction documents. Where no detail is indicated, the following components shall be anchored or braced to meet the force and displacement requirements prescribed in the 2022 CBC. Sections 1616A.1.18 through 1616A.1.26 and ASCE 7-16 Chapter 13, 26 and 30:
 - a) All permanent equipment and components.
 - b) Temporary or movable equipment that is permanently attached (e.g. hard wired) to the building utility services such as electricity, gas or water shall include electrical connections except plugs for 110.220 volt receptacles having flexible cable.

- c) Temporary, movable or movable equipment which is heavier than 400 pounds or has a center mass located 4 feet or more above the adjacent floor or roof level that directly support the components is required to be restrained in a manner approved by DSA.
- 2) The following mechanical and electrical components shall be positively attached to the structure but need not demonstrate design compliance with the references noted above. These components shall have flexible connections provided between the component and the associated ductwork, piping and conduit flexible connections must allow movement in both transverse and longitudinal directions.
 - a) Components weighing less than 400 pounds and have a center of mass located 4 feet or less above the adjacent floor or roof level that directly support the component.
 - b) Components weighing less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.
- b. Piping, Ductwork, and Electrical Distribution System Bracing requirements:
 - 1) Piping, ductwork, and electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7 Section 13.3 as defined in ASCE 7 Section 13.6.5, 13.6.6, 13.6.7 and 13.6.8; and 2022 CBC, Section 1617A.1.24, 1617A.1.25 and 1617A.1.26.
 - 2) The method of showing bracing and attachments to the structure of the identified distribution system are as noted below. The MEP design professional engineer responsible for content on these sheets has verified that the design methods identified below are in accordance with DSA IR 16-13.
 - 3) Mechanical piping (MP), mechanical ducts (MD), plumbing piping (PP), electrical distribution systems (E):
 - 4) Option 1: Project-Specific Design
 - 5) Option 2: Design based on OSHPD OPM, within project submittal
 - 6) Option 3: Design based on OSHPD OPM, deferred submittal.

D. Install tops of cabinets at 6 feet 6 inches above finished floor.

E. Install panelboards in cabinets, centered in door openings.

F. Secure panelboards to building structure to withstand wire pulling strains.

G. Secure surface mounted panelboards to wood studs or channel material spanning metal studs.

H. Do not use toggle bolts.

I. Provide identification:

1. For panelboards: Engraved, lamacoid plastic nameplate, white with black letters, giving panelboard designation, voltage, phase, wire and ampacity.
2. For branch circuit panelboards: Neatly typewritten circuit directory in cardholder inside panelboard door. Identify rooms served using room numbers corresponding to those finally established at the project.
3. All nameplates to be stainless steel screw on types, no cement.

3.03 FIELD QUALITY CONTROL

- A. Perform manufacturer's recommended field test prior to energization.
- B. Provide copies of test results to Owner.

END OF SECTION

SECTION 262716
ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes:

1. Outlet and device boxes.
2. Pull and junction boxes.
3. Floor boxes and service fittings.
4. Boxes and fittings for hazardous locations.
5. Cabinets.
6. Hinged door enclosures.

B. Related Sections:

1. General electrical requirements: Section 260501.

C. The following related items are specified in Section 260533 - Raceways: conduit-body-type electrical enclosures and wiring fittings, wireways, and auxiliary gutters.

1.02 REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1. ANSI American National Standards Institute.
2. American Society for Testing and Materials.

ASTM 123 Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.

ASTM 167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

3. IEEE Institute of Electrical and Electronics Engineers.

4. CEC California Electrical Code (CEC).

5. National Electrical Manufacturers Association.

NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).

NEMA ICS6 Enclosures for Industrial Controls and Systems.

NEMA OS1 Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

NEMA OS2 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

6. NFPA National Fire Protection Association

7. Underwriters Laboratories, Inc.

UL 50 Electrical Cabinets and Boxes.

UL 514A Electrical Metallic Outlet Boxes.

UL 514B Fittings for Conduit and Outlet Boxes.

UL 514C Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers.

UL 886 Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

1.03 SUBMITTALS

A. In addition to this Section, the submittal requirements of Section 260501, "General Electrical Requirements" are applicable.

B. Product data: Boxes, cabinets, and fittings.

C. Shop drawings: Provide boxes, cabinets, and enclosures that are to be shop fabricated (non-stock items). For shop fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes. For cabinets and hinged enclosures, drawings shall include dimensions, knockout sizes and locations, material types and gauges, finishes, and installation method.

D. Certificates shall include labels of Underwriters' Laboratories, Inc., and National Electrical Manufacturer's Association affixed to each item.

E. Record actual locations and mounting heights of outlet-, pull-, and junction-boxes, and cabinets and hinged door enclosures, on project record documents.

1.04 DEFINITIONS

A. Cabinet: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.

B. Device Box: An outlet box designed to house a receptacle device, or a wiring box

designed to house a switch.

- C. Enclosure: A box, case, or cabinet, or housing for electrical wiring or components.
- D. Hinged Door Enclosure: An enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box.
- E. Outlet Box: A wiring enclosure where current is taken from a wiring system to supply utilization equipment.
- F. Wiring Box: An enclosure designed to provide access to wiring systems or for the mounting of indicating devices or of switches for controlling electrical circuits.

1.05 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.
- B. Electrical Component Standard: Components and installation shall comply with CEC, "California Electrical Code."
- C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.
- D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."
- E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.06 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.07 PROJECT CONDITIONS AND SITE CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify locations of boxes, cabinets, and enclosures prior to rough-in.
- C. Placement shown on Drawings in approximate locations unless dimensioned. Install as

required to complete wiring system.

1.08 SEQUENCING

- A. Install boxes, cabinets, and enclosures in coordination with other work, and at times required to prevent delays in the work and to avoid cutting of masonry units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, provide products by the following, or equal:

A. General:

Appleton Electric Company
Hubbell
Steel City
O.Z./Gedney
Hoffman
Circle AW

B. Boxes and fittings for hazardous locations:

Crouse Hinds
Killark Electric Mfg.
Robroy Industries
Spring City Electrical Mfg.
Woodhead Industries

C. Floor Boxes:

Hubbell
Raco
Thomas & Betts
Walker
Wiremold

D. Cabinets:

Circle AW
Hoffman Engineering
Spring City Electrical Mfg.

2.02 GENERAL

Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

A. Materials and Finishes:

1. Sheet steel: Flat-rolled, code-gauge, galvanized steel.
2. Fasteners for general use: Corrosion-resistant screws and hardware, including cadmium and zinc-plated items.
3. Fasteners for wet or damp locations: Stainless steel screws and hardware.
4. Cast metal for boxes, enclosures and covers: Copper-free aluminum except as otherwise indicated.
5. Exterior finish: Gray-baked enamel for items exposed in finished locations except as otherwise indicated.
6. Painted interior finish: Where indicated, white baked enamel.
7. Fittings for boxes, cabinets, and enclosures: Conform to UL 514B. Malleable iron or zinc-plated steel for conduit hubs, bushings and box connectors.

2.03 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES

- A. General: Conform to UL 514A and UL 514B. Boxes shall be of type, shape, size, and depth to suit each location and application.
- B. Steel Boxes: NEMA OS 1. Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.
- C. Cast Aluminum Boxes: Copper-free aluminum with gasketed covers, threaded raceway entries, and features and accessories suitable for each location including mounting ears, threaded screw holes for devices and closure plugs.
- D. Cast Iron Boxes: Iron alloy, waterproof, with gasketed covers and threaded raceway entries, and features and accessories suitable for each location including mounting ears, threaded screw holes for devices and closure plugs.
- E. Floor Boxes:
1. Cast Iron Floor Boxes: Fully adjustable, waterproof, with threaded raceway entrances, adjusting rings, gaskets, and brass floor plates. Where indicated, provide

- multi-section boxes with individual hinged section covers and provide a duplex receptacle under one or more of the covers.
2. Steel Floor Boxes: Sheet steel, concrete tight, fully adjustable, with stamped knockouts, adjusting rings, and brass floor plates. Where indicated, provide multi-section boxes with concealed individual section covers under a common flush floor plate. Provide for a duplex receptacle in one of the concealed section covers and a one inch diameter bushed opening in the other.
 3. Service Fittings for Floor Outlet Boxes: Surface mounted horizontal, cast aluminum type, three inches high, suitable for finished spaces and finished in stain aluminum, except where otherwise indicated. Provide duplex receptacle or one inch diameter bushed opening for telephone or other communications service as indicated. Equip fitting for attaching flat to floor box cover.

2.04 NONMETALLIC OUTLET, DEVICE, AND SMALL WIRING BOXES

- A. General: Conform to NEMA OS 2, and UL 514B and 514C. Boxes shall be high-impact resistant molded PVC units with covers and integrally molded raceway entrance hubs and removable mounting flanges. Boxes shall be equipped with threaded screw holes for device and cover plate mounting, be equipped with an integral ground lug, and be of the type, shape, size, and depth to suit location and application.
 1. Boxes for Concealed Work: Mounting provisions and wiring entrances to suit installation conditions and wiring method used.
 2. Boxes for Exposed Work: Ultraviolet-stabilized, non-conductive, high impact-resistant boxes with integrally molded raceway entrance hubs and removable mounting flanges. Boxes shall be equipped with threaded screw holes for device and cover plate mounting. Each box shall have a molded cover of matching PVC material suitable for the application.

2.05 PULL AND JUNCTION BOXES

- A. General: Conform to UL 50, for boxes over 100 cubic inches in volume. Boxes shall have bolted-on covers of material same as box and shall be of the size and shape to suit the application.
- B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.
- C. Hot-Dip Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot dip galvanized after fabrication. Cover shall be gasketed.
- D. Stainless Steel Boxes: Fabricate of stainless-steel conforming to Type 302 of ASTM A

167. Where necessary to provide a rigid assembly, construct with internal structural stainless-steel. Cover shall be gasketed.

- E. Cast Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.
- F. Cast Nonmetallic Boxes: Ultraviolet stabilized, non-conductive, high impact-resistant PVC boxes with gasketed cover and integral mounting flanges.
- G. Boxes Approved for Classified Locations: UL 886. Cast metal or cast nonmetallic boxes, listed and labeled for use in the specific location classification, and with the specific hazardous material encountered. Conduit entrances shall be integral threaded type.

2.06 CABINETS

- A. General: Conform to UL 50.
- B. Construction: Sheet steel, NEMA 1 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one-piece frame and hinged door. Arrange door to close against a rabbet placed around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24 inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24 inches apart and not over 6 inches from top and bottom of door. For flush cabinets, make the front approximately 3/4 inch larger than the box all around. For surface mounted cabinets make front same height and width as box.
- C. Doors: Double doors for cabinets wider than 24 inches. Telephone cabinets wider than 48 inches may have sliding or removable doors.
- D. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks shall be of a type to permit doors to latch closed without locking.

2.07 STEEL ENCLOSURES WITH HINGED DOORS

- A. General: Conform to UL 50.
- B. Construction: Sheet steel, 16 gauge minimum, with continuous welded seams. NEMA class as indicated, arranged for surface mounting.
- C. Doors: Hinged directly to cabinet and removable, with approximately 3/4-inch flange around all edges, shaped to cover edge of box. Provide handle-operated key locking latch. Individual door width shall be no greater than 24 inches. Provide multiple doors where required.
- D. Mounting Panel: Provide painted removable internal mounting panel for component

installation.

- E. Enclosure: NEMA 12, except as indicated. Where door gasketing is required, provide neoprene gasket attached to oil-resistant adhesive, and held in place with steel retaining strips. For all enclosures of class higher than NEMA 1, use hubbed raceway entrances.

2.08 CAST METAL ENCLOSURES WITH HINGED DOORS

- A. Copper-free aluminum with bolted, hinged doors. Where used at classified locations, enclosures shall conform to UL and shall be listed and labeled for the classification of hazard involved.

2.09 MOLDED NONMETALLIC ENCLOSURES WITH HINGED DOOR

- A. General: Molded, glass fiber reinforced high impact strength polyester with bolt or screw-secured doors and solid neoprene gaskets.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements, except as otherwise indicated:

1. Interior dry locations: NEMA type 1, sheet steel

- a. In dry walls for single and two gang outlets provide 4S and 4D boxes, for 3 or more outlets use masonry boxes.
- b. In block and masonry walls provide masonry boxes of depths required for wall thickness.
- c. In poured concrete and plastered walls provide 4S and 4D boxes for single gang outlets and 2G and 3G-5075 boxes for multiple ganged outlets.
- d. In concrete ceilings provide OCR rings. In other ceilings provide 40 and 40D boxes. Omit covers if standard canopy and device plates entirely cover the ceiling opening.

2. Locations exposed to weather or dampness: Cast metal, NEMA type 3R.

3. Wet locations: NEMA type 4 enclosures.

- a. In exposed work, exterior of buildings, in wet location, and flush in non-waterproofed walls below grade provide FS and FD boxes.

4. Corrosive locations: NEMA type 4X enclosures.
 5. Hazardous (Classified) locations: Cast metal, UL 886, NEMA type listed and labeled for the location and class of hazard indicated.
- B. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types as follows, except as otherwise indicated:
1. Interior dry locations: NEMA type 1, sheet steel.
 2. Locations exposed to weather or dampness: NEMA type 3R, sheet steel.
 3. Wet locations: NEMA type 4 enclosures.
 4. Corrosive locations: NEMA type 4X enclosures.
 5. Hazardous (Classified) locations: Cast metal, UL 886, NEMA type listed and labeled for the location and class of hazard indicated.
- C. Floor Boxes: In slabs on grade and wet locations: Use NEMA type 4 boxes. At other locations in slabs, use concrete tight NEMA 1 boxes.
1. Provide floor boxes with quantity of gangs as required for power, communication, or control as indicated. Use boxes with barriers where required. Provide carpet flanges in carpeted areas.
- D. Hinged Door Enclosures: NEMA type 12, except as indicated.
- E. Hinged Door Enclosures Outdoors: NEMA type 3R, with drip hood, factory tailored to individual units.
- F. Hinged Door Enclosures in Corrosive Locations: NEMA type 4X nonmetallic enclosure.
- G. Cabinets: Flush mounted, NEMA enclosure type 1, except as otherwise indicated.

3.02 INSTALLATION, GENERAL

- A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.
- B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs. Provide standard manufactured plugs in unused openings of boxes.
- C. Support and fasten items securely in accordance with Division 26 Section "Supporting Devices."

Contractor shall be responsible for anchors and connections of electrical work to building structure to prevent damage as a result of earthquake, including the connection and integrity of field-fabricated materials and equipment. All building connections therefore shall be designed to resist seismic forces in conformance with Title 24 of the California Administrative Code.

Contractor shall submit shop drawings sealed by a Structural Engineer registered in the State of California to demonstrate compliance with the following requirement:

a. Component Anchorage Requirements:

- 1) All mechanical, plumbing, and electrical components shall be anchored and installed per the details on the DSA approved construction documents. Where no detail is indicated, the following components shall be anchored or braced to meet the force and displacement requirements prescribed in the 2022 CBC. Sections 1616A.1.18 through 1616A.1.26 and ASCE 7-16 Chapter 13, 26 and 30:
 - a) All permanent equipment and components.
 - b) Temporary or movable equipment that is permanently attached (e.g. hard wired) to the building utility services such as electricity, gas or water shall include electrical connections except plugs for 110.220 volt receptacles having flexible cable.
 - c) Temporary, movable or movable equipment which is heavier than 400 pounds or has a center mass located 4 feet or more above the adjacent floor or roof level that directly support the components is required to be restrained in a manner approved by DSA.
- 2) The following mechanical and electrical components shall be positively attached to the structure but need not demonstrate design compliance with the references noted above. These components shall have flexible connections provided between the component and the associated ductwork, piping and conduit flexible connections must allow movement in both transverse and longitudinal directions.
 - a) Components weighing less than 400 pounds and have a center of mass located 4 feet or less above the adjacent floor or roof level that directly support the component.
 - b) Components weighing less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.

b. Piping, Ductwork, and Electrical Distribution System Bracing requirements:

- 1) Piping, ductwork, and electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7 Section 13.3 as defined in ASCE 7 Section 13.6.5, 13.6.6, 13.6.7 and 13.6.8; and 2022 CBC, Section 1617A.1.24, 1617A.1.25 and 1617A.1.26.
- 2) The method of showing bracing and attachments to the structure of the identified distribution system are as noted below. The MEP design professional engineer responsible for content on these sheets has verified that the design methods identified below are in accordance with DSA IR 16-13.
- 3) Mechanical piping (MP), mechanical ducts (MD), plumbing piping (PP), electrical distribution systems (E):
- 4) Option 1: Project-Specific Design
- 5) Option 2: Design based on OSHPD OPM, within project submittal
- 6) Option 3: Design based on OSHPD OPM, deferred submittal.

D. Sizes shall be adequate to meet CEC volume requirements, but in no case smaller than sizes indicated.

E. Remove sharp edges where they may come in contact with wiring or personnel.

F. Do not provide through-the-wall and back-to-back boxes. Provide a minimum of 24" between outlet boxes on all fire-rated walls.

G. Provide boxes at the terminal of conduit runs to outlets and devices.

H. Center outlets in paneling and in other Architectural features.

I. Locate light fixture outlets in uniform relation with ceiling tiles.

J. Group outlets on circuits with homeruns as indicated on the drawings.

K. Provide plaster rings and covers where required by the building structure.

3.03 INSTALLATION OF OUTLET BOXES

A. Outlets at windows and doors: Locate close to window trim. For outlets indicated above doors, use 6 feet-9 inches mounting height above finished floor and center outlets above the door opening except as otherwise indicated.

B. Column and pilaster locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of

partitions.

- C. Locations in special finish materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Sawcut all recesses for outlet boxes in exposed masonry walls.
 - 1. Provide 1" deep plaster rings on recessed outlet boxes installed in areas where concrete will be exposed after construction is complete.
 - 2. Where boxes are concealed in exposed concrete unit masonry, use square cornered type boxes, or boxes fitted with rings of sufficient depth for the box to be recessed completely within cavity of block or tile. Install box to insure that ring fits an opening sawed out of the masonry, so that no mortar is required to fill between ring and construction.
- D. Gasketed boxes: At the following locations use cast metal, threaded hub-type boxes with gasketed weatherproof covers:
 - 1. Exterior locations.
 - 2. Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations.)
 - 3. Where exposed to moisture-laden atmosphere.
 - 4. At food preparation equipment within four feet of steam connections.
 - 5. Where indicated.
- E. Cast iron boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.
- F. Mounting: Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles either vertically or horizontally but consistently either way. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.
 - 1. Provide 3/8-inch studs in ceiling- and wall-mounted lighting fixture outlet boxes where shop drawings of fixtures require and elsewhere as may be required for fixtures.

- G. Ceiling outlets: For fixtures, where wiring is concealed, use octagonal outlet boxes, 4 inches by 2 inches deep, minimum.
- H. Cover plates for surface boxes: Use plates sized to box front without overlap.
- I. Protect outlet boxes to prevent entrance of plaster and debris. Thoroughly clean foreign material from boxes before conductors are installed.
- J. Floor boxes: Install in concrete floor slabs so they are completely enveloped in concrete except for the top. Where normal slab thickness will not envelop box as specified above, provide increased thickness of the slab. Provide each compartment of each floor box with grounding terminal consisting of a washer-in-head machine screw, not smaller than No. 10-32, screwed into a tapped hole in the box. Adjust covers of floor boxes flush with finished floor.

3.04 INSTALLATION OF PULL AND JUNCTION BOXES

- A. Pull boxes and junction boxes shall be securely mounted to the building structure.
 - 1. Fastenings shall be made by means of not smaller than 3/16" diameter bolts, expansion bolts, or toggle bolts not smaller than No. 9" x 1" wood screws; or by equivalent fastenings; where exposed to weather or moisture, shall be galvanized. Do not use nails, or wood or fiber inserts in masonry.
 - 2. On masonry or concrete walls, columns or flooring, fastenings shall be made by means of lead expansion shields not smaller than size 3/8" diameter by 5/8" long for use with No. 10-24 round head machine screws. Machine screws shall be not less than 1-1/4" long for installation on ceiling and not less than 1" long elsewhere.
 - a. Holes for lead expansion shields shall be carefully and accurately drilled, using sharp drills to a depth which will afford the maximum practical engagement of threads (depth equal to screw length not less than 1-1/4" past plaster into solid concrete). Installation shall develop full strength of screw.
- B. Pullboxes for concealed wiring shall be mounted flush in walls, partitions, and ceilings, unless otherwise indicated.
 - 1. Use cast iron boxes flush in slab on grade.
- C. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8-inches square by 4-inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box.
- D. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 inches inside boxes.

- E. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.
- F. Size: Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by NEC Article 370, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

3.05 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES

- A. Installations shall be secure and substantial; cabinets shall be attached to building walls or structure.
- B. Mount with fronts, trim, and doors straight and plumb.
- C. Install with tops 78 inches above finished floor.
- D. Set cabinets in finished spaces flush with walls.
- E. Identification: Provide identification nameplates on inside and outside of covers and doors on each cabinet and hinged enclosure, engraved Bakelite with 1/4-inch minimum height letters, securely fastened with stainless steel screws. Text shall identify the function of the cabinet or enclosure, for example, "Dimming Panel," unless otherwise indicated.

3.06 GROUNDING

- A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box, or enclosure.

3.07 CLEANING AND FINISH REPAIR

- A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks. Clean surfaces to be painted.
- B. Galvanized finish: Repair damage using a zinc-rich paint recommended by the manufacturer.
- C. Painted finish: Repair damage using matching corrosion-inhibiting touch-up coating.

END OF SECTION

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SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes:

1. Receptacles.
2. Snap Switches.
3. Incandescent Lamp Dimmer-Switches.
4. Fluorescent Lamp Dimmer-Switches.
5. Wall Plates.
6. Floor Service Outlets.
7. Poke-Through Assemblies.
8. Telephone/Power Poles.

B. Related Sections:

1. General electrical requirements: Section 260501.

1.02 REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1. ANSI American National Standards Institute
2. ASTM American Society for Testing and Materials
3. IEEE Institute of Electrical and Electronics Engineers
4. CEC California Electrical Code (CEC)
5. NECA National Electrical Contractors Association: "Standard of Installation"
6. NEMA National Electrical Manufacturers Association
7. NFPA National Fire Protection Association
8. Underwriters Laboratories, Inc.

UL 20 General Use Snap Switches

UL 94.3 UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 486A Wire Connectors and Wiring Lugs for Use with Copper Conductors

UL 498	Molded-Case Circuit Breakers and Circuit Breaker Enclosures
UL 1010	Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations
WD 1	General Requirements for Wiring Devices
WD 6	Wiring Device-Dimensional Requirements

1.03 SUBMITTALS

- A. General: Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Product Data: Submit for each type of product specified.
- C. Installation instructions: Manufacturer's written installation instructions for wiring devices. Include instructions for storage, handling, protection, examination, and preparation of Product.
- D. Samples: Provide samples under specific request.

1.04 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.
- B. Electrical Component Standard: Components and installation shall comply with CEC, "California Electrical Code."
- C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.
- D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."
- E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.06 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown prior to commencing the work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by the following:

Crouse-Hinds
Hubbell
Pass and Seymour
Square D
Walker

2.02 WIRING DEVICES

- A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Verify color of all device plates with Project Architect or Interior Designer prior to placing order.
- B. Receptacles: UL 498 and NEMA WD 6. Straight blade, two-pole, three-wire grounding type, except as otherwise indicated below:

RECEPTACLES: RATINGS AND TYPES [1]					
OUTLET TYPE	CURRENT RATING	VOLTAGE RATING	NEMA CONFIGURATION	UL GRADE	MANUFACTURER [5]
Duplex	20 A	125 V	5-20R	Heavy Duty	Hubbell 5362
Duplex, GFI [2]	20 A	125 V	5-20R	Heavy Duty w/Integral GFI	Hubbell GF5362
Duplex, Hospital	20 A	125 V	5-20R	Hospital	Hubbell 8300
Single	20 A	125 V	5-20R	Heavy Duty	Hubbell 5361
Single	20 A	250 V	6-20R	Heavy Duty	Hubbell 5461
Single, Locking [3]	20 A	125 V	L5-20R	Heavy Duty	Hubbell 2310
Single, Locking [3]	20 A	250 V	L6-20R	Heavy Duty	Hubbell 2320

Pin and Sleeve [4]	As Required	As Required	Not Applicable	498-General; 1010- Classified Locations	Hubbell

Notes: 1. Except as otherwise indicated.
2. GFI receptacles shall protect downstream receptacles on same circuit.
3. Provide locking receptacles with black nylon face, except as otherwise indicated.
4. Provide features indicated.
5. Verify color selection with Architect/Engineer. (As listed, each catalog number specifically indicates the color of the device - revision may be required.)

- C. Switches: UL 20 and NEMA WD 1. Quiet toggle-type AC switch. Ratings and types, except as otherwise indicated:

SWITCHES: RATINGS AND TYPES [1]				
TYPE	LOAD RATING	VOLTAGE RATING	UL GRADE	MANUFACTURER [4]
Single Pole	20 A	120/277 V	Heavy Duty	Hubbell HBL 1221
Double Pole	20 A	120/277 V	Heavy Duty	Hubbell HBL 1222
Three Way	20 A	120/277 V	Heavy Duty	Hubbell HBL 1223
Four Way	20 A	120/277 V	Heavy Duty	Hubbell HBL 1224
Single Pole w/Pilot Light [2]	20 A	120/277 V	Heavy Duty	Hubbell HBL 1221- PL7
Single Pole w/Key Switch	20 A	120/277 V	Heavy Duty	Hubbell HBL 1221- L
Momentary Contact Type [3]	20 A	120/277 V	Heavy Duty	Hubbell HBL 1557

Notes: 1. Except as otherwise indicated.
2. For switch with pilot light, the light is "ON" when the load is "ON".
3. For momentary contact type switch, operation is three position - two circuit momentary contact and center off.
4. Verify color selection with Architect/Engineer. (As listed, each catalog number specifically indicates the color of the device - revision may be required.)

- D. Dimmer Switches: Solid-state dimmer switches, mount in outlet boxes as indicated and in accordance with the following:

1. Incandescent Lamp Dimmer: Modular type, 120-volts, 60-Hz, switch poles and wattage as indicated, with continuously-adjustable rotary knob or toggle, anodized aluminum face, with soft-tap or other quiet on-off switch. Equip with electromagnetic filter to eliminate noise, RF and TV interference, and 5-inch minimum wire connecting leads. Derate dimmer switch per manufacturer's

recommendations where dimmers are ganged together.

2. Fluorescent Lamp Dimmer: Full-wave modular type AC dimmer for fluorescent fixtures; wattage and voltage ratings as indicated, and electromagnetic filter to eliminate noise, RF and TV interference. Construct with continuously-adjustable trim potentiometer with adjustment of low and dimming, anodized heat sinks, with quiet on-off switch and 5-inch minimum wire connecting leads. To ensure coordination with dimming type ballasts in fixtures, specific dimming device shall be approved for use in writing by the ballast manufacturer.

2.03 WIRING DEVICE ACCESSORIES

- A. Wall Plates: Single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which they are attached, and are from the same manufacturer. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Wall plate color shall be as selected by Architect / Engineer. Provide wall plate color to match wiring devices except as otherwise indicated. Provide wall plates with engraved legend where indicated. Conform to requirements of Section 260553, "Electrical Identification."
 1. Interior Areas: Smooth, high-impact resistant plastic, of the same manufacturer as the device.
 - a. Voice, data, or video communications system outlets: Same as for wiring devices except with 3/8 inch or 1 inch rubber grommets as required.
 - b. Surface mounted outlet boxes: Zinc coated sheet steel rounded edges, same size as outlet box.
 - c. Kitchen and food preparation areas: Polished stainless steel type, 0.40 inches thick.
 2. Exterior areas: Weatherproof, corrosion-resistant type, die cast aluminum with self-closing gasketed cover. For duplex receptacles, use Hubbell 5206-WO or equal; for wall switches, use Hubbell 7420 or equal; for GFI receptacles, use manufacturer's listed plate.
- B. Floor Service Outlets: Modular, above-floor service outlets and fittings of types and ratings indicated. Construct of die-cast aluminum, satin finish. Use design compatible with floor outlet wiring methods indicated. Provide 20-ampere, 125-volt, gray duplex receptacle. Provide with 3/4 inch or 1-inch NPT, 1-inch long, locking nipple for installation where compatible with wiring method.
- C. Poke-Through Assembly Devices: Factory-fabricated poke-through assembly devices with multi-channeled thru-floor raceway/firestop assembly and below-floor junction box assembly.

1. Above-floor service pedestal: Include service outlets in above-floor four-gang service fitting of die-cast satin-finish aluminum with one 20 ampere, 125 volt, gray NEMA 5-20R duplex receptacle and one duplex modular duplex voice/data communications jack, including separation barrier between line- and low-voltage section. Provide integral assembly UL listed as a total unit, with fire rating consistent with that of floor penetrated. Provide through-floor fitting: Hubbell Type PT7XC, plus a below-floor junction box; and service pedestal: Hubbell Type FR480.
 2. Flush-floor service assembly: Include service outlets in flush-floor brass service fitting with one 20 ampere, 125 volt, NEMA 5-20R duplex receptacle and two openings for up to one 25-pair telephone cable per opening. Provide integral assembly UL listed as a total unit, with fire rating consistent with that of floor penetrated. Receptacle shall be protected when not in use with independent, spring-loaded lift covers. Provide one-piece through-floor fitting including carpet flange: Hubbell Type PT7FBRS2; and duplex receptacle: Hubbell Series 5352.
- D. Telephone/Power Service Poles: Factory-assembled combination telephone/power poles of types, sizes, and ratings indicated; for use with telephone and power systems installed above suspended ceilings. Construct with provisions for one 50-pair telephone cable, and two-20 ampere, 125 volt, three-wire receptacles. Isolate power section from telephone compartment with separating metal barrier. Extend wiring from receptacles to junction box at top of pole where connections are made above suspended ceiling. Provide ceiling trim plate and pole foot with carpet pad. Where poles are located in accessible ceiling areas, provide bracing arranged for positive connection to ceiling supports. Provide finish treatment and color as selected by the Architect/Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install wiring devices and accessories as indicated, in accordance with manufacturers written instructions, applicable requirements of the CEC, and in accordance with recognized industry practices to fulfill project requirements.
 1. Mount switches and receptacles in vertical position in building interiors.
 2. Mount receptacles with weatherproof plates in horizontal position.
 3. Install receptacles mounted vertically so that the ground contact falls on the top position, and horizontally mounted receptacles with neutral pole in top position.
 4. Individually Mounted Dimmers: Install in accordance with manufacturer's ventilation clearance requirements.
- B. Coordinate with other Work, including painting, electrical boxes and wiring installations,

as necessary to interface installation of wiring devices with other Work.

- C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt and debris.
- D. Install wiring devices after wiring work is completed.
- E. Install wallplates after painting work is completed.
- F. Install telephone/power service poles - in accordance with final furnishings arrangement - plumb, true, and secure.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturers' torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A. Use properly-scaled torque indicating hand tool.

3.02 INSPECTION

- A. Inspect boxes into which wiring devices are to be installed for defects which affect the quality and execution of work.
- B. Do not start work until defects are corrected.

3.03 PREPARATION

- A. Determine where types of wiring devices are to be installed.
- B. Verify devices are of correct size, capacity, type, and NEMA configuration.

3.04 ADJUSTMENT

- A. Align device and cover plate vertically and horizontally assuring flush fitting.

3.05 PROTECTION

- A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.06 FIELD QUALITY CONTROL

- A. Testing: Prior to energizing circuits, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.

- B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

END OF SECTION

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SECTION 262801
LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section Includes:

1. Circuit breakers and fuses, rated 600 volts and below.
 - a. Also included: enclosed circuit breakers for independent mounting.

B. Related Sections:

1. General electrical requirements: Section 260501.

1.02 REFERENCES

- A. Drawings and general provisions of the Contract, including General- and Supplementary- Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 6.

- B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1. ANSI American National Standards Institute
2. ASTM American Society for Testing and Materials
3. Institute of Electrical and Electronics Engineers

IEEE 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

4. CEC California Electrical Code (CEC)
5. NECA National Electrical Contractors Association "Standard of Installation"
6. National Electrical Manufacturers Association

NEMA250 Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA AB 1 Molded-Case Circuit Breakers

NEMA FU 1 Low Voltage Cartridge Fuses

NEMA KS 1 Enclosed Switches

7. NFPA National Fire Protection Association
8. UL Underwriters Laboratories, Inc.

UL 98	Enclosed and Dead-Front Switches
UL 198C	High-Interrupting-Capacity Fuses, Current-Limiting Type Fuses
UL 198E	Class R Fuses
UL 198F	Plug Fuses
UL 486A	Wire Connectors and Wiring Lugs for Use with Copper Conductors
UL 486B	Wire Connectors for Use with Aluminum Conductors
UL 489	Molded-Case Circuit Breakers and Circuit Breaker Enclosures
UL 943	Ground-Fault Circuit Interrupters
UL 977	Fused Power-Circuit Devices

1.03 SUBMITTALS

- A. General: Submit the following in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Shop Drawings: Submit shop drawings and or brochures to include but not limited to minimum melting and total clearing time charts for all fuses.
- C. Product Data: Submit for each type of product specified. Include manufacturer's bulletins, and minimum melting and total clearing time charts for each type of fuse.
- D. Operating, Maintenance, and Instructional Data: Manufacturers' written operating, maintenance, and installation instructions, including directions for storage and protection, handling, examination, and preparation.
 - 1. In addition, include copies of this data in Operating and Maintenance Manuals submitted, see Section 260501.
- E. Samples: Provide samples upon specific request.
- F. Certificates:
 - 1. Labels of UL listing, fixed to each item of material.

1.04 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.
- B. Electrical Component Standard: Components and installation shall comply with CEC, "California Electrical Code."
- C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.

- D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."
- E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."
- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.06 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown prior to commencing the work.

1.07 COORDINATION

- A. For equipment furnished by the Owner, or under other Divisions: Size fuses in accordance with the California Electrical Code.

1.08 EXTRA MATERIALS

- A. Furnish 3 of each type and size of fuse installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Circuit Breakers:
 - 1. General Electric Co.
 - 2. Square D Co.
 - 3. Cutler-Hammer

- B. Fuses:
 - 1. Bussmann only.

2.02 MATERIALS AND FABRICATION

A. Circuit Breakers:

1. Circuit Breakers: Molded case, quick-make, quick-break, thermal-magnetic, trip-free with individual inverse time tripping mechanism on each pole. Terminal lugs rated for copper and aluminum conductors. Minimum 10,000 amperes interrupting capacity, RMS symmetrical short circuit rating shall be required. All breakers shall meet or exceed the maximum available fault current as indicated on single line diagram.
 - a. Use magnetic-only circuit breakers for motor applications.
 - b. Provide Class A (5ma sensitivity) breakers where GFI type breakers are required.
 - c. Provide "HACR" type circuit breakers for HVAC loads. Ratings shall be as indicated on the drawings.
 - d. No tie handle on multi-pole circuit breaker is accepted.
 - e. Provide ambient compensated type breaker where the breaker is installed in the ambient in excess of 40 degrees C (104 degrees F).

B. Fuses:

1. Class RK1:
 - a. 250V; LPN-RK, Lowpeak
 - b. 600V; LPS-RK
2. Class L: KRP-C, Hi-Cap
3. Or as otherwise shown on the drawings.

PART 3 - EXECUTION

3.01 APPLICATION

A. Types: Mains, Feeders and Branch Circuits.

1. 600 Amps and Below: Dual-element construction (current limiting, time-delay and high interrupting capacity) providing thermal protection for both fuse and fuseholder. Interrupting rating shall be 300,000 amperes RMS symmetrical and peak let-thru current and energy let-thru values shall not exceed the values established by Underwriters' Laboratories Standard for Class RK-1 fuses. Fuses shall be Bussmann "Low Peak Yellow™" in color and shall be Bussmann Low-Peak Dual Element Fuses, types LPN-RK (250 volts) or LPS-RK (600 volts). The fuses shall have separate overload and short-

circuit elements. The fuses shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuit clearing chamber. Fuses shall be "Low Peak Yellow™". CAUTION labels to alert the end user of the engineered level of protection of the electrical equipment, shall be field installed by the electrical contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure. These labels are available with the spare fuse cabinet (SFC) and are also available upon request from Bussmann.

2. Above 600 Amps: Time delay type; shall hold 500% of rated current for a minimum of 4 seconds and clear 20 times rated current in .01 seconds or less. Interrupting ratings shall be 200,000 amperes RMS symmetrical and peak let-thru current and energy let-thru values shall not exceed the values established by Underwriters' Laboratories for Class L fuses. Fuses shall be Bussmann "Low Peak Yellow™" in color and shall be Bussmann LOW PEAK type KRP-C. The fuses shall employ "O" rings as positive seals between the end bells and the glass melamine fuse barrel. The fuse links shall be pure silver links (99.9% pure), to limit the short circuit current let-through values to low levels and comply with NEC Sections requiring component protection. The terminals shall be panned. CAUTION labels to alert the end user of the engineered level of protection of the electrical equipment, shall be field installed by the electrical contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure. These labels are available with the spare fuse cabinet (SFC) and are also available upon request from Bussmann.

B. Motor Circuits - All individual motor circuits with full load amperes rating (FLA) of 480 amperes or less shall be protected by BUSSMANN LOW-PEAK Dual-Element, time delay to provide type 2 coordination for the controller, Fuses LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for motors with a marked service factor not less than 1.15 or with a marked temperature rise not over 40 degrees Centigrade, shall be installed in ratings of approximately 125% of motor full load current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly such as large fans. Under such conditions the fuse should be 150% to 175% of the motor full load current. Larger H.P. motors shall be protected by BUSSMANN Type KRP-C Low-Peak Time-Delay Fuses of the ratings shown on the drawings. All other motors, (such as 1.0 service factor motors) shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in ratings of approximately 115% of the motor full load current except as noted above. The fuses shall be U.L. Class RK1 Dual Element Time Delay or Class L. CAUTION labels to alert the end user of the engineered level of protection of the electrical equipment, shall be field installed by the electrical contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure. These labels are available with the spare fuse cabinet (SFC) and are also available upon request from Bussmann.

C. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) or BUSSMANN Low-Peak KRP-C Time Delay

Fuses as shown on the drawings. The fuses shall be U.L. Class RK1 or Class L. Protection shall be based on the circuit breakers interrupting capacity, as outlined in the Bussmann Bulletin PMCB. CAUTION labels to alert the end user of the engineered level of protection of the electrical equipment, shall be field installed by the electrical contractor. they shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure. These labels are available with the spare fuse cabinet (SFC) and are also available upon request from Bussmann.

- D. Provide Class RK1 fuses for motors, feeder circuits, and other circuits not specified below 0-600 amps.
- E. Provide Class RK1 fuses for lighting loads, 0-600 amps:
 - 1. For fluorescent ballasts - Type GLR.
 - 2. For other ballasts and control circuits - Type KTK.
- F. Provide Class L fuses for all applications, 601 amps and larger.
- G. Special Applications:
 - 1. Fluorescent fixtures shall be protected by Bussmann fuses GLR or GMF with holder HLR. They shall have individual protection on the line side of the ballast. A fuse and holder shall be mounted within or as part of the fixture. Size and type of fuse to be recommended by the ballast manufacturer.
 - 2. All other ballast-controlled lighting fixtures shall be protected by Bussmann fuses type KTK or FNQ with holders HEB, HPF, or HPS. They shall have individual protection on the line side of the ballast. Fuse and holder shall be mounted in a location convenient for changing fuses. Holder shall be mounted in protected location or be an in-line waterproof holder. Size and type of fuse to be recommended by the ballast manufacturer or as indicated on plans.

3.02 INSTALLATION

- A. Set adjustable circuit breakers with trips as indicated.
- B. Provide separate neutral conductors for circuits protected by GFI breakers.
- C. Provide Class RK5 fuses for motors, feeder circuits, and other circuits not specified below 0-600 amps.
- D. Provide Class RK1 fuses for lighting loads, 0-600 amps:
 - 1. For fluorescent ballasts - Type GLR.

2. For other ballasts and control circuits - Type KTK.

E. Provide Class L fuses for all applications, 601 amps and larger.

F. Fuses shall be shipped separately. Any fuses shipped installed in equipment, shall be replaced by contractor with new fuses as specified above prior to energization at no additional expense to Owner. All fuses shall be stored in moisture free packaging at job site and shall be installed immediately prior to energization of the circuit in which it is applied.

3.03 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates with 1/4-inch minimum height letters indicating:

1. Circuit designation at branch overcurrent devices in distribution panelboards, switchboards and motor control centers.

2. Circuit designation of panel or device controlled on circuit breakers, individually enclosed.

B. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

3.04 SPARES

A. In addition to fuses consumed during testing, furnish 10%, but not less than three each of each size and type fuses used for the project and store where directed by Owner. Mount spare fuses in a NEMA 1 lockable cabinet with full plywood backboard.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1. PART 1 - GENERAL

1.1 SUMMARY

1.1.1. This Section Includes:

1.1.1.1. Enclosed safety switches for use on feeders and branch circuits, and disconnect switches for motors and equipment.

1.1.2. Related Sections:

1.1.2.1. General electrical requirements: Section 260501.

1.2 REFERENCES

1.2.1. Drawings and general provisions of the Contract, including General- and Supplementary-Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

1.2.2. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

- 1.2.2.1.** ANSI American National Standards Institute
- 1.2.2.2.** ASTM American Society for Testing and Materials.
- 1.2.2.3.** IEEE Institute of Electrical and Electronics Engineers.
- 1.2.2.4.** CEC California Electrical Code.
- 1.2.2.5.** NECA National Electrical Contractors Association "Standard of Installation".
- 1.2.2.6.** National Electrical Manufacturers Association

1.2.2.6.1. NEMA KS 1 Enclosed Switches

- 1.2.2.7.** NFPA National Fire Protection Association
- 1.2.2.8.** Underwriters Laboratories, Inc.

- 1.2.2.8.1.** UL 98 Enclosed and Dead Front Switches
- 1.2.2.8.2.** UL 198C High-Interrupting Capacity Fuses; Current Limiting Type
- 1.2.2.8.3.** UL 198E Class R Fuses
- 1.2.2.8.4.** UL 977 Fused Power Circuit Devices

1.3 SUBMITTALS

1.3.1. General: Submit the following in accordance with the General- and Supplementary-Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements".

1.3.2. Shop Drawings: Include enclosure dimensions, type, electrical ratings, fuse provision, installation instructions, and nameplate nomenclature.

1.3.3. Product Data: Submit for each type of product specified.

1.3.4. Operating, Maintenance, and Instructional Data: Manufacturers' written operating,

maintenance, and installation instructions, including directions for storage and protection, handling, examination, and preparation.

1.3.4.1. In addition, include copies of this data in Operating and Maintenance Manuals submitted, see Section 26 05 01.

1.3.5. Samples: Provide samples upon specific request.

1.3.6. Certificates: Labels of UL listing, fixed to each item of material.

1.4 QUALITY ASSURANCE

1.4.1. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.

1.4.2. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code."

1.4.3. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.

1.4.4. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation".

1.4.5. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements".

1.5.2 Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

1.6.1. Verify that field measurements are as shown prior to commencing the work.

1.7 COORDINATION

1.7.1. For equipment furnished by the Owner, or under other Divisions: Size fuses in accordance with the National Electrical Code.

1.8 EXTRA MATERIALS

1.8.1. Furnish 3 of each type and size of fuse installed.

2. PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

2.1.1. Alley Bradley

2.1.2. Furnas

2.1.3. Cutler-Hammer

2.1.4. Siemens

2.1.5. General Electric

2.2 MATERIALS

2.2.1. For single phase motors under 2 horsepower Allen Bradley Bulletin 600 single phase manual switch, toggle type, with locking attachment, neon pilot light, heater elements sized per motor nameplate rating, NEMA 1 enclosure indoors, NEMA 4 enclosure exterior, in damp and wet locations, flush and surface as specified for outlet boxes.

2.2.2. For other 250 volt equipment: NEMA Type HD, General Electric Type TH, fusible and non-fusible as required by CEC, with cover interlocks, with cabinets, with threaded hubs. Refer: Section 262816.

2.2.3. Provide heavy duty type, quick-make, quick-break disconnects with cover interlocks.

2.2.4. Provide NEMA Type 1 enclosure for dry locations, provide the proper enclosure for other locations as indicated.

2.2.5. Provide motor rated toggle switches where indicated.

2.2.6. Provide Bryant #3003 disconnect for 3 phase motors up to 5 horsepower.

2.2.7. Provide fused disconnect for elevator drive motors.

2.2.8. Provide rejection clips on disconnects where rejection type fuses are to be installed.

3. PART 3 - EXECUTION

3.1 INSPECTION

3.1.1. Inspect building structure to which disconnects are to be secured for defects which affect the execution and quality of work.

3.1.2. Do not start work until defects are corrected.

3.2 PREPARATION

3.2.1. Carefully measure and lay out exact locations maintaining working clearances required by the National Electrical Code.

3.3 INSTALLATION

3.3.1. Provide disconnects where indicated and where required by the National Electrical Code.

3.3.2. Install within sight of equipment served.

3.3.3. Provide final connection to equipment served.

3.3.4. Provide nameplate secured to cabinet with designation of equipment served, operating voltage, and circuit designation.

3.3.5. The anchorage of motor and circuit disconnects required for elevator drives, emergency generator, emergency motor loads, fire pumps and emergency lighting shall be designed in accordance with Section 1613A of the California Building Code.

3.4 LABELING AND IDENTIFICATION

- 3.4.1.** Provide engraved plastic nameplates with 1/4 inch minimum height letters indicating:
 - 3.4.1.1.** Circuit designation at branch overcurrent devices in distribution panelboards, switchboards and motor control center.
 - 3.4.1.2.** Circuit designation of panel for device controlled on disconnects which are individually enclosed.
- 3.4.2.** Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION

SECTION 26 56 11
EXTERIOR LIGHTING (LED)

1. PART 1 GENERAL

1.1. SUMMARY

1.1.1. This Section includes lighting fixtures for exterior application, including:

1.1.1.1. Lighting fixtures (for exterior applications).

1.1.1.2. Poles and mounting accessories.

1.1.1.3. Exterior lighting system-associated control devices:

1.1.1.3.1. Photocell switches.

1.1.1.3.2. Time switches.

1.1.1.3.3. Lighting contactors.

1.1.2. Related Sections:

1.1.2.1. LIGHTING FIXTURE SCHEDULE: See Drawings.

1.1.2.2. Cast in place concrete: Applicable Section in Division 3.

1.1.2.3. Finishes: Applicable Section in Division 9.

1.1.2.4. General electrical requirements: Section 260501.

1.2. REFERENCES

1.2.1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

1.2.2. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

1.2.2.1. American National Standards Institute/American National Standard Lighting Group

ANSI/ANSLG – C78.377-2008 Specifications for the Chromaticity of Solid-State Lighting Products

ANSI/ANSLG – C82.77-2002 Harmonics Emission Limits.

1.2.2.2. ASTM American Society for Testing and Materials.

1.2.2.3. Federal Communication Commission (FCC) 47 CFR Part 15 – Radio Frequency Devices.

1.2.2.4. IEEE Institute of Electrical and Electronics Engineers.

1.2.2.5. CEC California Electrical Code. CEC 2022.

1.2.2.6. Illuminating Engineering Society of North America (IESNA) LM-79-, LM-80-15, and TM-21.

1.2.2.7. National Electrical Manufacturers Association (NEMA)

SSL-1-2010 Electronic Drivers for LED Devices, Arrays, or Systems

SSL-3-2010 Solid State Lighting High Power LED Binning for General Illumination.

SSL-4-2012 Solid State Lighting Retrofit Lamps.

1.2.2.8. NECA National Electrical Contractors Association "Standard of Installation".

1.2.2.9. National Electrical Manufacturers Association

NEMA WD 6 Wiring Devices - Dimensional Requirements

1.2.2.10. California Electrical Code. CEC 2022

1.2.2.11. California Building Code. CBC 2022.

1.2.2.12. Underwriters Laboratories, Inc.

UL 57 Fixtures, Electric Lighting

UL 924 Emergency Lighting and Power Equipment

UL 8750 Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.3. SUBMITTALS

1.3.1. General: Submit the following in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."

1.3.1.1. Product data, shop drawings, instructions for installation and calibration, operating and maintenance instruction, and reports, shall employ the terminology, classifications, and methods prescribed by the Illuminating Engineering Society (IESNA) - see IES Lighting Handbook, latest edition - except as otherwise indicated, for the lighting system specified.

1.3.2. Shop Drawings:

1.3.2.1. Lighting Fixtures: Include dimensions, accessories, and installation and construction details; photometric data, including Zonal lumen data, average and minimum ratio, aiming diagram and [computerized] candlepower distribution data.

1.3.2.2. Poles and Mounting Accessories: Include dimensions, wind load determined in accordance with AASHTO LTS-2, pole deflection, pole class, and other applicable information.

1.3.3. Product Data: Submit for each type of product specified.

When data that describes more than one type, size, model, or item is submitted, clearly mark the data to indicate which type, size, model, or item is being provided. Data shall be sufficient to show conformance to specified requirements. Include for:

1.3.3.1. Lighting fixtures

1.3.3.2. Poles and mounting accessories.

1.3.3.3. Exterior lighting system-associated control devices:

1.3.3.3.1. Photocell switches.

1.3.3.3.2. Time switches.

1.3.3.3.3. Lighting contactors.

1.3.4. Operating, Maintenance, and Instructional Data: Manufacturers' written operating, maintenance, and installation instructions, including directions for storage and protection, handling, examination, and preparation.

1.3.4.1. In addition, include copies of this data in Operating and Maintenance Manuals submitted, see Section 260501.

1.3.5. Samples: One sample for each of the following:

1.3.5.1. Lighting fixtures (one sample for each type), complete with lamp and ballast.

1.3.6. Certificates:

1.3.6.1. Labels of UL listing, fixed to each item of material

1.3.7. Certified Test Reports:

1.3.7.1.1. Lighting fixtures. Computerized horizontal illumination levels in footcandles at ground level, taken every 10 feet. Include average maintained footcandle level and maximum / minimum ratio.

1.3.7.1.2. Distribution data according to "IES classification type" as defined in the IES Lighting Handbook.

1.3.7.2. Field Test Reports: Submit test results of field tests herein specified.

1.4. QUALITY ASSURANCE

1.4.1. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.

1.4.2. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code."

1.4.3. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.

1.4.4. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."

1.4.5. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.5. DELIVERY, STORAGE AND HANDLING

1.5.1. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections, and Section 260501, "General Electrical Requirements."

1.5.2. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.6. PROJECT CONDITIONS OR SITE CONDITIONS

1.6.1. Verify that field measurements are as shown prior to commencing the work.

2. PART 2 PRODUCTS

2.1. LUMINAIRES

2.1.1. General: U.L. 1572. Provide luminaires as indicated. Provide luminaires complete with lamps of the number, type, lumens and wattage indicated. The details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of any particular manufacturer. Luminaires of similar designs and equipment, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

2.1.2. Lamps:

2.1.2.1. Light Emitting Diode (LED)

2.1.3. LED driver.

2.2. LIGHTING CONTACTOR

2.2.1. General: NEMA ICS 2. Electrically operated, mechanically held contactor rated 120 and/or 277volts, 20 amperes, 1-pole or as indicated on schedule. Provide in NEMA enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts and coil clearing contacts and shall require no arcing contacts. Provide contactor with hand-off-automatic [on-off] selector switch. Contactor shall be hermetically sealed.

2.3. TIME SWITCH

2.3.1. Astronomic dial type arranged to turn "ON" at sunset, and turn "OFF" at predetermined time between 8:30 p.m. and 2:30 a.m. or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide switch with automatically wound spring mechanism to maintain accurate time for a minimum of 15 hours following power failure. Provide time switch with a manual on-off bypass switch. Housing for the time switch shall be surface mounted, NEMA 3R enclosure conforming to NEMA ICS 6.

2.4. PHOTOCELL SWITCH

2.4.1. General: U.L. 773 or U.L. 773A. Hermetically sealed cadmium-sulphide cell rated 120 volts ac, 60 hertz with single-throw contacts rated 1000] watts, and 120 volts. Mount switch in a cast weatherproof aluminum housing with swivel arm designed to mount on or beside each luminaire or integral to the luminaire. The switch shall turn on below 3 footcandles and off at 3 to 10 footcandles. A time delay shall prevent accidental switching from transient light sources. Mount a directional lens in front of the cell to prevent fixed light sources from creating a turnout condition. Aim switch according to manufacturer's recommendations.

2.5. POLES

2.5.1. General: Provide poles designed for wind loading of 100 miles per hour determined in

accordance with AASHTO LTS-2 while supporting luminaires having effective projected areas indicated. Poles shall be anchor-base type designed for use with underground supply conductors.

2.5.2. Concrete Poles: Not Used.

2.5.3. Aluminum Poles: Provide aluminum poles manufactured of corrosion resistant aluminum alloys conforming to AASHTO LTS-2 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3,5) for cast alloys. Poles shall be seamless extruded or spun seamless type. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire.

2.5.4. Steel Poles: Not Used.

2.5.5. Fiberglass Poles: Not Used.

2.6. BRACKETS AND SUPPORTS

2.6.1. General: ANSI C136.3. Pole brackets shall be not less than 1-1/4-inch galvanized steel pipe or aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to the luminaires provided, and all brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position the luminaire no lower than the mounting height indicated. In no case shall the brackets be less than 24 feet above the street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with the luminaire head.

2.7. ANCHOR BASE ASSEMBLIES

2.7.1. Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; Entire anchor bolt/rod shall be galvanized per ASTM A 153. Anchor bases for steel poles shall be structural quality hot-rolled carbon steel plate having a minimum yield strength of 36,000 psi. Anchor bases for aluminum poles shall be cast from 356-T6 aluminum alloy per ASTM B 108.]

3. PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. General: ANSI C2, NFPA 70, and to the requirements specified.

3.1.2. Aluminum and Steel Poles: Provide anchor bases with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide galvanized nuts, washers, and ornamental covers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods shall be as specified in Section 260526, "Underground Electrical Work." Thoroughly compact backfill with compacting arranged to prevent any pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location. All poles shall be factory finished/painted in colors specified as part of lighting fixture schedule and confirmed as part of shop drawing process.

3.1.3. Pole Setting: Depths shall be as indicated to achieve overall pole/fixture finish height per drawings. Poles in straight runs shall be installed in a straight line. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6-inch maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

3.2. GROUNDING

- 3.2.1.** Ground noncurrent-carrying parts of equipment [including metal poles] as specified in Section 260526, "Underground Electrical Work." Where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.3. EARTHWORK

- 3.3.1.** Provide all necessary trenching, backfilling and reconditioning of surfaces for all electrical work.

3.4. FIELD TESTS

- 3.4.1.** General: The Contractor shall provide electric power required for field tests.
- 3.4.2.** Operating Test: Upon completion of installation, conduct an operating test to show that the equipment operates in accordance with the requirements of this specification section.
- 3.4.3.** Insulation Resistance Test and Circuit Identification / Labeling: Perform as specified in Section 260519, Wire and Cable, both before and after connection of fixtures and equipment.

END OF SECTION

SECTION 27 1000
TELECOMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Description: Work includes the following:
 - 1. Structured Cabling System (SCS) supporting various low-voltage systems.
 - 2. Telecommunications Rooms and Spaces.
 - 3. Grounding and Bonding Infrastructure.
 - 4. Manufacturer Certification.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and Section 260501 apply to Work in this section.

1.02 RELATED SECTIONS

- A. Related Sections
 - 1. 27 4100 – Classroom Audio Visual System
 - 2. 27 5123 – IP Intercom and Clock System
 - 3. 28 1000 – Access Control System
 - 4. 28 2000 – Video Surveillance System
 - 5. 28 3100 – Intrusion Detection System

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
 - 1. Installation Standards: Comply with following standards for cable and equipment installations. Publications shall be latest issue and addenda:
 - a) NEC, National Electric Code.
 - b) NESC, National Electric Safety Code.

- c) TIA-568.0-D, Generic Telecommunications Cabling for Customer Premises.
 - d) TIA-568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements.
 - e) TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
 - f) TIA-568.3-D, Optical Fiber Cabling Components Standards.
 - g) TIA-569-D, Commercial Building Standard for Telecommunications Pathways and Spaces.
 - h) TIA-606-B, Administration Standard for the Telecommunications Infrastructure of Commercial Building.
 - i) TIA-607-C Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises.
 - j) TIA-758-B, Customer Owned Outside Plant Telecommunications Cabling Standard.
 - k) TIA-862-B, Structured Cabling Infrastructure for Intelligent Building Systems.
 - l) TIA-526-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7.
 - m) TIA-526-14-B, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant-OFSTP-14.
 - n) IEEE 802.3-2000. Ethernet Standard.
 - o) BICSI 001, Information Transport Systems Design Standard for K-12 Educational Institutions.
 - p) BICSI Information Transport Systems Installation Methods Manual.
 - q) BICSI Telecommunications Distribution Methods Manual.
2. Contractor shall have read the above documents and shall be familiar with the requirements that pertain to this installation. The documents may be obtained from:
- a) Global Engineering Documents, 15 Inverness Way East, Englewood, CO, 80112-5776, 800-854-7179, <http://global.ihs.com/>
 - b) BICSI, 8610 Hidden River Parkway, Tampa, FL, 33637, 800-242-7405, www.bicsi.org
3. Materials:
- a) UL listed and labeled. Install label to be visible.

- b) Equipment: Regularly catalogued items of manufacturer and supplied as complete unit in accordance with manufacturer's standard specifications with optional items required for proper installation unless otherwise noted in this section.
- c) Telecommunications connectivity and cabling independently tested to meet current TIA standards.

C. Qualifications:

- 1. Contractor performing work specified in this section is required to have special skills obtained by education, experience, or both.
- 2. Contractors bidding work specified herein shall have a minimum of seven years of experience in the construction, testing, and servicing of systems of the type and magnitude specified in this section.
- 3. Contractor shall be a certified installer of the telecommunications system and pre-qualified by the manufacturer for the purpose of offering the Applications Assurance warranty at the time of bid.
- 4. Contractor shall have direct access to the tools and test equipment required to complete the Work at the time of bid.
- 5. Project manager (in office) and superintendent (field) shall have 5 years of experience at project manager and superintendent levels, respectively, on completed telecommunications projects of like magnitude and complexity as to this project. Project manager shall be certified as a Registered Communications Distribution Designer (RCDD) through Building Industry Consulting Service International (BICSI).
 - a) RCDD shall be a direct employee of the company bidding on said Work.
- 6. Field technicians who will work independently at any given time during the project on the structured cabling system shall have a minimum of 3 years' experience on completed telecommunications projects of like magnitude and complexity as to this project. Field technicians working at job site shall have completed a copper technician installation training class conducted by the warranting manufacturer or BICSI.
- 7. Field technicians who will work independently at any given time during the project on the optical fiber systems shall have a minimum of 3 years' experience on completed telecommunications projects of like magnitude and complexity as to this project. Field technicians working at the job site shall have completed an optical fiber technician installation training class conducted by the warranting manufacturer or BICSI.

1.04

SUBMITTALS

- A. Comply with requirements in Division 01 and Section 260501.
 - 1. Submit complete at one time. Partial product submittals are not acceptable and will be returned unreviewed.
- B. Pre-Construction Submittal:
 - 1. Labeling
 - a) Include sample labeling for each of the following telecommunications infrastructure components:
 - 1) Workstation device faceplate identification labeling. Include label per telecommunications room.
 - 2) 110 cross-connect block wall fields for horizontal, intra-building, and inter-building backbone terminations.
 - 3) Surface mount and rack mount fiber cabinets for horizontal, intra-building, and inter-building backbone terminations.
 - 4) Multi-pair copper intra-building and inter-building backbone cabling identification tags.
 - 5) Optical fiber intra-building and inter-building backbone cabling identification tags.
 - 2. Product Data
 - a) Submit with data arranged under basic categories, such as, certifications, personnel training, manufacturer warranty, products, test equipment and calibration, and similar items. Include index with the submittals.
 - b) Organize by specification infrastructure component sections described in Part 1 and Part 2 of this section.
 - c) Submit Product Data information sheets for coordination with item and model number.
 - d) Where more than one product is indicated on a page, mark product with arrow or by other means to identify exact product or products being submitted by specific part number.
 - e) Submit network test equipment proof of calibration by manufacturer.
 - f) Submit resumes and certifications of technicians and project manager who will support this project. Certifications shall include:
 - 1) Manufacturer's certification to provide warranty

- 2) RCDD certification
 - 3) Copper and optical fiber installation certification
 - 4) Approved manufacturer classes satisfactorily completed
3. Shop Drawings
 - a) Submit Shop Drawings of telecommunications cabling systems.
 - b) Coordinate with other trades prior to submittal and start of installation.
 - c) Show exact routing of horizontal cabling for workstation distribution throughout building, and intrabuilding and interbuilding copper and optical fiber backbone cabling.
 - d) Label workstation devices to identify cabling being terminated in telecommunications rooms and spaces.
 - e) Prepare shop drawings using AutoCAD. Submit shop drawings in full size PDF format.

C. Test Reports:

1. Prepare test reports and submit to the Owner's Representative an electronic copy of the detailed test results, including overall test summary report.
2. Include a copy of the detailed test reports on flash drive in each Operation and Maintenance Manual.
3. Include a hard copy of the summary test sheets in each Operation and Maintenance Manual.
4. Submit electronic copies in PDF and LinkWare software formats, including LinkWare reader software.

D. Record Drawings:

1. Keep complete set of telecommunications drawings in job-site office updated within 3 days to show actual installation of cabling and equipment during construction.
2. Use of this set of drawings for recording as-built conditions.
3. Indicate where material, equipment, and system component are installed differently from that indicated on the Contract Drawings, clearly and neatly using ink or indelible pencil in color red during construction.
4. Prepare electronic set of Record Drawings, incorporating changes during construction. Submit Record Drawings to the Owner's Representative for review and acceptance.

5. Submit Record Drawings using latest version of AutoCAD software or as approved by the Owner, and in PDF format. Request (from architect) final architectural background drawing files that incorporate floor plan and program spaces numbering modifications.
6. AutoCAD drawings shall be e-transmitted to include backgrounds, title blocks and other associated files.
7. Submit electronic copy of Record Drawings in full-size PDF and AutoCAD format, on flash drive.
8. Prepare laminated hard copy of telecommunications floor plan drawings, telecommunications room layouts, and equipment rack elevations. Install in each telecommunications room for associated floor area served.
 - a) Floor plan drawings shall be full-size, scaled down drawings shall not be acceptable.

E. Project Closeout:

1. Submit closeout documentation to the Owner's Representative and Architect under provisions of Division 01, Section 260501 and this section.
2. Provide project closeout documentation including but not limited to; test result documentation, Record Drawings, manufacturer warranty certificates and Operation and Maintenance manuals.

1.05 DEFINITIONS

Accessible ceiling: An area above acoustical ceiling tiles/grid (or lay-in type ceilings) with a readily accessible space. Gypboard ceilings with access hatches and open to structure spaces shall not be considered accessible ceilings

Administration: Methodology defining the documentation requirements of a cabling system and its containment, the labeling of functional elements, and the process by which moves, additions, and changes are recorded

Bonding: Permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed

Cable: An assembly of one or more insulated conductors or optical fibers within an enveloping sheath

Cable run: Length of installed media, which may include other components along its path

Cabling: System of cables, cords, and connecting hardware

Channel: End-to-end transmission path between 2 points at which application-specific equipment is connected including test cords and patch cords for a maximum total distance of 328 feet (100 meters)

Connecting hardware: Device, or combination of devices, used to connect cables or cable elements

Consolidation point: Location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways

Cross-connection: Connection scheme between cabling runs, subsystems, and equipment using patch cords or jumpers that attach to connecting hardware on each end

Demarcation point: Point where operational control or ownership changes

Equipment room: Environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate cross-connect

Ground: Conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of earth

Horizontal cabling: Distribution media that connects the telecommunications outlet/connector at the work area and the first piece of connecting hardware in the horizontal cross-connect

Horizontal cross-connect: Group of connectors that allows equipment and backbone cabling to be cross-connected with patch cords or jumpers

Infrastructure (telecommunications): Collection of those telecommunications components, excluding equipment, that together provides basic support for the distribution of information within a building or campus

Local area network (LAN): Standard industry term for a network installation that serves a relatively small area (for example, structured cabling installation serving a building)

Main cross-connect: Cross-connect normally located in the (main) equipment room for cross-connection and interconnection of entrance cables, first-level backbone cables, and equipment cables

Modular jack: Female telecommunications connector that may be keyed or unkeyed and may have 6 or 8 contact positions

Outlet/connector (telecommunications): Connecting device in the work area on which a horizontal cable or outlet cable terminates

Patch cord: Length of cable with connectors on both ends used to join telecommunications circuits/links at the cross-connect

Patch panel: Connecting hardware system that facilitates cable terminations and cabling administration using patch cords

Pathway: Sequence of connections that provides connectivity between devices on a network or between networks on an internetwork; the vertical and horizontal

route of the telecommunications cable; a facility for the placement of telecommunications cabling

Permanent link: Test configuration for link excluding test cords and patch cords for maximum total distance of 295 feet (90 meters)

Plenum: Compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system

Telecommunications Room: Enclosed architectural space for housing telecommunications equipment, cable terminations, and cross-connect cabling

Star topology: Network topology in which services are distributed from or through a central point

Telecommunications: Transmission, emission, and reception of signs, signals, writings, images, and sounds, that is information of any nature by cable, radio, optical, or other electromagnetic systems

Unshielded twisted pair (UTP): Cable made up of one or more pairs of twisted copper conductors with no metallic shielding; the entire assembly is covered with an insulating sheath (cable jacket)

Wireless access point: Stand-alone hardware device or computer wireless adapter with software that acts as a wireless communication hub for users of wireless devices to connect with each other and to bridge those devices to the cabled portion of the network

Wide area network (WAN): Data communications system that uses telecommunications circuits to link LANs that are distributed over large geographic distances

Wireless local area network (WLAN): Data communications system that uses using radio frequency technology, such networks transmit and receive data over the air, minimizing the need for wired connections; they combine data connectivity with user mobility

Work area (workstation): Building space where occupants interact with telecommunications terminal equipment

Work area cable (cord): Cable connecting the telecommunications outlet/connector to the terminal equipment

1.06 PRE-CONSTRUCTION MEETINGS

- A. Contractor shall attend the pre-construction meeting as required by the General Contractor or the Owner's Representative.
- B. Provide a schedule, indicating installation tasks, time duration for each task and coordination items to be discussed 5 days prior to the meeting, to the Contractor and to the Owner's Representative. Include milestone dates for network equipment installation and patch cord installation durations.

1.07 MANUFACTURER CERTIFICATION

- A. Structured cabling system shall be covered by an Extended Product and Application Assurance Warranty.
 - 1. Warranty shall cover passive telecommunications infrastructure copper and optical fiber connectivity and cabling products and performance from the date of installation registration and will support existing or future applications.
 - 2. Approved manufacturer solution partner and warranty is:
 - a) Berk-Tek/ Leviton Technologies – Limited Lifetime warranty
 - 3. Installation practices shall follow the installation guidelines and procedures specified in the manufacturer certified installer training course and current TIA standards.
 - 4. Submit closeout documentation in accordance with the manufacturer warranty requirements to comply for acceptance of warranty.
- B. Provide the original hard copy certificate for the Application Assurance Warranty to the Owner.

1.08 MATERIAL PROVISIONS

- A. Deliver materials to the Owner under provisions of this section.
- B. Contractor shall be responsible to provide a material transmittal for all materials being provided to the Owner as described herein and that are not permanently installed. Transmittal shall be signed by the Owner receiving the materials. Transmittal shall be included as part of the O&M manuals.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Substitutions: The substitution of products shall adhere to the requirements defined in Division 01 and this section.
 - 1. Submit requests for substitutions a minimum of 10 days prior to Bid date. Request submitted less than 10 days prior to, shall not be accepted.
 - 2. The basis of design for manufacturer partners is Berk-Tek cabling, and Leviton connectivity as specified herein.
 - 3. Copper connectivity shall be Augmented Category 6:
 - a. Pre-approved acceptable alternate manufacturer partners and connectivity are:
 - 1) Berk-Tek Cabling with Ortronics Connectivity.

- a) Copper: LANmark-SST cabling with TracJack modular jacks and Clarity (6-port module) patch panels.
 - 2) Superior Essex Cabling with Ortronics Connectivity.
 - a) Copper: Category 6A 10Gain cabling with Ortronics TracJack modular jacks and Clarity (6-port module) patch panels.
 - 3) Uniprise Cabling and Connectivity.
 - a) Copper: Category 6A Ultra 10 cabling with UNJ10G modular jacks and Universal 10G patch panels.
- 4. Optical fiber connectivity shall be OM4 Laser Optimized Multimode Fiber (LOMMF):
 - a. Pre-approved acceptable alternate manufacturer partners are:
 - 1) Berk-Tek Cabling with Ortronics Connectivity.
 - 2) Superior Essex Cabling with Ortronics Connectivity.
 - 3) Uniprise Cabling and Connectivity.

2.02 COPPER HORIZONTAL CABLING

A. Augmented Category 6 UTP cabling for interior spaces:

- 1. Horizontal cables shall be constructed from 23 AWG insulated solid bare copper conductors formed into four individually twisted pairs with three monofilaments.
- 2. Conductors shall have an impedance of $100\Omega \pm 10\%$ / 100m.
- 3. Cable performance shall be greater than the minimum compliant attributes by TIA-568-C standard. NEXT and PSNEXT shall be a minimum of 3.0dB/4.0dB and ACRF and PSACRF shall be a minimum of 8.0dB above the minimum required values.
- 4. Cables shall meet the most current technical characteristics of TIA-568-C.2 standard.
 - a) Wire map
 - b) Length
 - c) Insertion loss (Attenuation) 45.3dB/100m @ 500MHz
 - d) Near-end crosstalk (NEXT) loss 33.8dB/100m @ 500MHz
 - e) Attenuation to crosstalk ratio far-end (ACRF) 17.8dB/100m @ 500MHz
 - f) Minimum power sum alien near end crosstalk (PS-ANEXT) Loss 62.0dB @ 500MHz

- g) Minimum power sum attenuation to alien crosstalk ratio far-end (PS-AACRF) Loss 34.2 @ 500MHz
 - h) Return loss (RL) 15.2dB/100m @ 500MHz
 - i) Propagation delay (PD) 70% nom
 - j) Delay skew (DS) 45ns/100m max
5. Cables shall be NFPA 262 CMP (plenum) rated unless otherwise noted with a maximum cable diameter 0.250 inches.
- a) Manufacturer Berk-Tek LANmark-SST series:
 - 1) Yellow plenum rated, Part No. 11140403
 - 2) White plenum rated, Part No. 11140401
 - 3) Blue plenum rated, Part No. 11101842
 - 4) Green plenum rated, Part No. 11140404
 - 5) Gray plenum rated, Part No. 11140402

2.03 INTERBUILDING BACKBONE INFRASTRUCTURE

A. Singlemode Optical Fiber Cabling:

- 1. Interbuilding singlemode optical fiber backbone cabling shall be indoor/outdoor rated loose tube cable utilizing a dry water blocking system.
 - a) Singlemode optical fiber shall be Class IVa dispersion-unshifted per EIA/TIA-492CAAB secondary coating diameter of 242 μ m. Zero dispersion wavelength shall be between 1300 nm and 1324 nm.
 - b) Nominal mode field diameter shall be 9.2 m with a tolerance of +/- 0.5 m at 1310 nm.
 - c) Single-mode optical fiber shall meet the following performance specifications.
 - 1) Maximum Attenuation: 0.4/0.3 dB/km @ 1310/1550 nm
 - 2) Transmission distance: 1 GbE greater than 2 km @ 1310 nm
 - 3) Cutoff Wavelength: <1279 nm when measured in accordance with EIA/TIA-455-170 or EIA/TIA-455-80. Distance versus bandwidth shall be using a laser transmitter operating at a 1310 nm wavelength.
 - 4) Operating Temperature: -40C to +75C
 - 5) Storage Temperature: -40C to +85C

2. Cable shall meet the following standards: ISO/IEC 11801; ICEA S-87-640; Telcordia GR-20; Telcordia GR-409; ICEA S-104-696; ETL and UL OFNP (plenum) as specified herein, unless otherwise noted.

- a) Manufacturer Berk-Tek:

- 1) 12-strand plenum rated, Part No. LTP012AB0403

B. Multi-pair Copper Cabling:

1. Interbuilding 100 ohm unshielded twisted-pair backbone cabling shall be constructed with 24 AWG, solid annealed bare copper conductors, insulated with color coded solid polyolefin. All cable pairs shall be twisted, and core assemblies shall consist of 25 pair units. The core assembly shall be filled with an 80°C ETPR (Extended Thermoplastic Rubber) compound, completely filling the interstices between the pairs and under the core wrap. The core wrap shall be a non-hygroscopic dielectric tape. Shielding shall be corrugated, copolymer coated, 8-mil aluminum tape. Shielding shall be grounded and bonded to the ground system at each termination end. Cable shall be black low-density polyethylene material and marked with appropriate identifications.

2. Cables shall meet the electrical requirements of 100-ohm, backbone cabling as specified in TIA-568-C.

- a) Manufacturer Superior Essex, Sealpic-F series cable:

- 1) 25-pair, Part No. 04-097-21

C. Building Entrance Protection (BEP) Blocks:

1. Primary protection for interbuilding copper backbone cabling shall be at service entrance facilities as indicated on the Contract Drawings. Primary protection shall be multi-pair protector panel providing protection for circuits exposed to voltage surges and sneak currents, terminals shall be gold-plated, 110-type connector in and 110-type connector out, cables to feed from either top or bottom input entrance and utilizing individual 5-pin plug-in type protector units. Protector panel shall be UL Listed and REA approved. Entrance facility protector shall utilize in the splice chamber of the protector, a No. 6 ground strap, with eyelet for connection to the shield of the OSP cable and connected to the protector grounding network.

- a) Manufacturer Circa:

- 1) 25-pair, Part No. 1880ENA1/NSC-25

- b) Plug-in type protector units shall be gas and solid-state types, molded to glass-reinforced, high-heat-distortion plastic (polybutylene terephthalate), line pins shall be gold-plated and ground pins solder-plated. One protector unit is required for each terminated pair of cable used.
 - 1) Manufacturer Circa:
 - a) Gas-tube with current limiter, POTS Line Applications, Part No. 4B1E
 - b) Solid-state, Data Line Applications, Part No. 3B1FS-240
 - c) Solid-state with sneak current protection, Analog or Digital Voice Line Applications, Part No. 4B1FS-240

D. Cable Shield Bonding Connector

- 1. Connector shall have a spring top plate to remain in contact with the shield at all times. Connector shall penetrate the polymer coating on the cable shield to provide excellent pull-out strength and electrical contact.
 - a) Manufacturer Preformed, Part No. 8000751 or equal

2.04 INNERDUCT AND CABLE IDENTIFICATION TAGS

A. Textile Innerduct:

- 1. Textile innerduct shall contain multiple flexible, polyester/nylon textile resin polymer fabric textile cells per innerduct as indicated on the Contract Drawings. Innerducts shall be installed within conduit raceways. Innerduct cells shall be the color white and shall have footage markers indicated on the side of the cell.
- 2. Center spine of textile innerduct shall be installed in the color black or red when utilizing a 3-inch width. Black shall be the default color when only one set of innerduct is being installed within a conduit. Center spine of textile innerduct shall be installed in the color purple when utilizing a 2-inch width.
- 3. Cells within the textile innerduct shall contain a pull tape in differentiating colors. One cell shall have a pull tape in the color white, a second cell shall have a pull tape in the color white with a blue stripe and the third cell shall have a pull tape in the color white with an orange stripe.
 - a) Manufacturer MaxCell:
 - 1) 2-inch, 2 cell with the color black spine, Part No. MXE52222BKyyyy (yyyy = length in feet)

- 2) 3-inch, 3 cell with the color black spine, Part No. MXE64283BKyyyy (yyyy = length in feet)
 - 3) 3-inch, 3 cell with the color red spine, Part No. MXC64283RDyyyy (yyyy = length in feet)
4. Textile innerduct installation kits shall be provided for a single innerduct pack or multiple innerduct packs. Utilize an 1800 lbs. swivel device or a 2-way/ 3-way chain harness based upon the quantity of innerducts being installed within a conduit raceway.
- a) Manufacturer MaxCell:
 - 1) Single 1800 lbs. swivel, Part No. MXCSW600
 - 2) 2-Way chain pulling harness, Part No. MXC2CH
 - 3) 3-Way chain pulling harness, Part No. MXC3CH
5. Textile innerduct inflation termination bags shall be provided for each conduit. Inflation bags shall be provided in each outside plant conduit at the last maintenance hole that routes to either the associated telecommunications room or the exterior junction box on the building or structure. Inflation bags shall also be provided at the opposite end at the telecommunications room or the exterior junction box.
- a) Manufacturer MaxCell:
 - 1) 4-inch diameter Inflation Bag, Part No. MXCRTBVL100
 - 2) 3-inch diameter Inflation Bag, Part No. MXCRTBVL80
 - 3) 2-inch diameter Inflation Bag, Part No. MXCRTBVL50

B. Optical Fiber Flexible Plastic Innerduct:

1. Flexible duct/innerduct shall be UL 2024 with pull tape. Flexible duct/ innerduct shall be provided for all optical fiber cabling routed in open cabling pathways and backbone riser applications.
 - a) Manufacturer Carlon:
 - 1) 1-inch plenum, Part No. CF4X1C-xxx (where xxx = feet)
 - 2) 1-1/4-inch plenum, Part No. CG4X1C-xxx (where xxx = feet)
 - 3) 1-inch riser, Part No. DF4X1C-xxx (where xxx = feet)
 - 4) 1-1/4-inch riser, Part No. DG4X1C-xxx (where xxx = feet)

C. Copper and Optical Fiber Identification Tags:

1. Identification tags shall be self-laminating, write-on, rigid, non-adhesive, measuring 3.50" x 2.00", and with a vinyl material strength of 0.20". Attach the tags to the associated innerduct or directly to the cabling utilizing specified cable ties. The legend and nomenclature for optical fiber cabling shall read "CAUTION: FIBER OPTIC CABLE" and for copper cabling shall read "CAUTION: TELEPHONE CABLE". Each tag shall have sub attribute lines for "TYPE" and "COUNT". The tag color for optical fiber cabling shall be yellow and the tag color copper cabling shall be orange.
 - a) Manufacturer ACP International:
 - 1) Optical fiber cabling tags, Part No. VCT-200 (yellow)
 - 2) Copper cabling tags, Part No. VCT-201 (orange)
2. Cable tie shall be dome-top; barb type with stainless steel locking barb, material shall be Nylon 6.6 with a maximum width of .141".
 - a) Manufacturer Panduit or equal:
 - 1) 6.1-inch length, Part No. BT1.5I-C0
 - 2) 8.0-inch length, Part No. BT2I-C0

2.05 TELECOMMUNICATIONS WORKSTATION DEVICES

A. Category 6A RJ-45 Jacks:

1. Category 6A RJ-45 jacks shall be dual reactance technology, non-keyed, universal T568A/B pin configuration standard and used to terminate Category 6A UTP cabling as specified herein. RJ-45 jacks shall be high impact plastic housing, flame retardant UL 94V-O, modular contacts shall be beryllium copper, nickel plating under 50 micro-inches gold plating in contact area. IDC contacts shall be phosphor bronze, nickel under plating with tin lead over plate serving 22 through 24 AWG.
 - a) Manufacturer Leviton:
 - 1) Category 6A RJ-45 Jacks:
 - a) White, Part No. 6110G-RW6
 - 2) Blank module in package of 10:
 - a) White, Part No. 41084-BW

B. Faceplates:

1. Faceplate shall be manufactured to hold 8P8C modules with recessed designation strips with clear plastic covers in accordance with the TIA-606-B labeling standard.

- a) Manufacturer Leviton:
 - 1) 4-port thermoplastic:
 - a) White, Part No. 42080-4WS

C. Surface Mount Boxes:

- 1. Surface mount boxes shall be thermoplastic to hold 8P8C modules with recessed designation strips with clear plastic covers in accordance with the TIA-606-B labeling standard.
 - a) Manufacturer Leviton:
 - 1) 1-Port white, Part No. 41089-1WP
 - 2) 2-Port white, Part No. 41089-2WP

2.06 DIRECT CONNECT AND ALARM CONNECTIVITY

A. Direct Connect Assemblies:

- 1. Assemblies shall exceed requirements for Cat 6A performance and be designed for UTP and Shielded channels. Cable and connector shall be plenum rated with 18-inch 26 AWG stranded conductor cable. Assemblies shall be terminated with a factory 8-position modular plug on one end and a field terminated zinc alloy coupler body at the other end.
 - a) Manufacturer Leviton, White, Part No. SBCPI-18W
- 2. Assemblies shall meet Cat 6A performance and be designed for UTP channels. Cable and connector shall be plenum rated with 24 AWG solid conductor cable. Assemblies shall be terminated with a factory 8-position modular plug on one end and a field terminated ceiling connector body at the other end.
 - a) Manufacturer CommScope:
 - 1) 18-inch white, Part No. CO1SJO2-88N018
 - 2) 36-inch white, Part No. CO1SJO2-88F003

B. Direct Connect Connectivity and Terminations:

- 1. RJ-45 Modular Plugs
 - a) Pre-approved Category 6A 8-position, 8-conductor 8P8C plugs shall be provided based on the warranting manufacturer for the direct attach termination to solid conductor Category 6A cabling.
 - b) 8P8C plugs shall be compatible to be terminated on both Category 6 and Category 6A cabling.

- c) 8P8C plugs shall be field terminated with manufacturer approved termination tool. No other termination tools shall be authorized for the termination of these direct attach terminations.
- d) Plugs with a plastic boot shall be plenum rated when used in an air-plenum environment.
- e) Adhere to manufacturer's plug installation guidelines and testing procedures to ensure proper performance and signal transmission.
 - 1) Category 6A modular plug and termination tool approved manufacturers:
 - a) Bel Stewart
 - b) Sentinel
 - c) Allen Tel

2.07 TELECOMMUNICATIONS ROOM SUPPORT EQUIPMENT

A. Fire Retardant Plywood Backboards:

- 1. Plywood backboards shall be 3/4" fire retardant ACX plywood to cover the walls as indicated in the Contract Drawings. Backboard shall bear a seal identifying the plywood is fire retardant. Backboard shall be painted white with the seal left exposed for permanent identification.

B. Ladder Rack:

- 1. Ladder rack as specified herein shall be installed within the IDF Room only.
- 2. Ladder rack shall be prefabricated metal structure consisting of longitudinal stringer side rails with cross members welded at 12-inch intervals on center.
- 3. Both stringer side rails and cross members shall be constructed of 3/8-inch x 1-1/2-inch x 0.065-inch wall rectangular steel tubing. No portion of the cross-member rungs shall protrude below the bottom or above the top plane of the side rails.
- 4. Additional hardware required to construct the designed runway shall be those recommended by the manufacturer. Mounting supports shall be based upon the building conditions of the space. Utilize wall or ceiling/structural support mounting methods only, ladder rack shall not be attached to or supported by the equipment rack. Provide seismic bracing of the ladder rack as required by the AHJ. Cable loading shall meet the loading requirements of NEMA 12C.
 - a) Manufacturer CPI:
 - 1) Universal cable runway, Part No. 10250-7xx (xx = width of ladder rack)

- 2) Cable runway radius bends:
 - a) 90-degree outside vertical bend, Part No.10723-7xx (xx = width of ladder rack)
 - b) 90-degree inside vertical bend, Part No. 10724-7xx (xx = width of ladder rack)
 - c) E-bend horizontal, 12" and 18" only, Part No. 10822-7xx (xx = width of ladder rack)
- 3) Cable runway corner bracket, 15-inch, Part No. 11959-715
- 4) Cable retaining posts, 6-inch, Part No. 10596-706
- 5) Protective end caps, 1-pair, Part No. 10642-001
5. Vertical wall brackets shall be provided within 12-inches of each end of the cable runway and spaced at a maximum of 5-feet apart.
 - a) Manufacturer CPI, Part No. 10608-701
6. Wall angle support kits shall be provided where cable runway terminates perpendicular to the wall. Wall angle support kits consist of one wall angle bracket, two j-bolts and attachment hardware.
 - a) Manufacturer CPI, Part No. 11421-7xx (xx = width of ladder rack)
7. Triangular bracket support kits shall provide wall support for ladder tray. Supports shall be constructed of 1/4" x 2" aluminum bar and have a load rating of 100 lbs. Supports kits shall consist of one triangular bracket, j-bolts and attachment hardware.
 - a) Manufacturer CPI:
 - 1) Ladder rack width 12-18 inches, Part No. 11312-718
8. Triangular bracket support kits shall provide wall support for ladder tray. Supports shall be constructed of cold rolled steel and have a load rating of 400 lbs. Supports kits shall consist of one triangular bracket, j-bolts and attachment hardware.
 - a) Manufacturer CPI:
 - 1) Ladder rack width 9-18 inches, Part No. 11746-718
9. Threaded ceiling kits shall be provided where cable runway runs parallel to the wall and above equipment racks at intervals not to exceed 5-feet. Ceiling kits consists of one ceiling support bracket, one 5/8-inch x 6-foot-long threaded rod, one runway support bracket and four 5/8-inch hex nuts. Provide (2) kits at each support location.
 - a) Manufacturer CPI:
 - 1) Threaded ceiling kit, 1 kit, Part No. 11310-003

- 2) For locations where the ceiling height exceeds the 6-foot threaded rod length, provide 5/8-inch threaded rod coupling kit and 5/8-inch threaded rod.
 - a) Threaded rod coupling kit, Part No. 10697-002
 - b) Threaded rod, 5/8-inch x 12-feet, Part No. 11440-004
 - c) Threaded rod, 5/8-inch x 8-feet, Part No. 11440-005
 - d) Threaded rod, 5/8-inch x 4-feet, Part No. 11440-006
10. Radius drop out brackets shall be provided at all sections along the ladder rack where cabling enters and exits the horizontal pathway. Movable cross members shall be provided for radius drops where fixed rungs are not positioned directly over the side channels of the equipment rack.
 - a) Manufacturer CPI:
 - 1) Cross member radius drops, Part No. 12100-7xx (xx = width of ladder rack)
 - 2) Stringer radius drops, Part No. 12101-711
 - 3) Movable cross member cable runway, Part No. 12115-7xx (xx = width of ladder rack)
11. Splice kits shall be utilized to connect sections in accordance with manufacturer's recommendations.
 - a) Manufacturer CPI:
 - 1) Butt-splice kit, Part No. 11301-701
 - 2) Junction-splice kit, Part No. 11302-701
 - 3) 45-degree runway splice kit, Part No. 11313-701
12. Ground straps shall be provided to bond cable runway sections at butt and junction splice points. Ground strap kit consists of 8-inches of #6AWG green insulated wire attached at both ends to two-hole compression lugs and attachment hardware. The cable runway shall be bonded to the telecommunications grounding and bonding system.
 - a) Manufacturer CPI, Part No. 40164-001
13. Elevation kits shall be installed above racks or cabinets to provide additional space between the tops of the racks or cabinets and the ladder rack for radius drop fittings and maintaining cable bend radius at transitions from horizontal to vertical.
 - a) Manufacturer CPI:
 - 1) Rack elevation kit, 4-6 inches, Part No. 10506-706

C. Wall Mounted Cable Management

1. 110 Jumper Troughs shall have with legs and be mounted above and below each 100-pair or 300-pair 110 wiring block kit.
 - a) Manufacturer Ortronics, Part No. 30200140
2. Flexible D-rings shall be provided for routing and managing cabling on backboards.
 - a) Manufacturer Panduit, Part No. CMVDR2

2.08 TELECOMMUNICATIONS GROUNDING AND BONDING

A. Telecommunications Grounding Busbar (TGB):

1. TGB shall be a copper plate, 1/4" thick x 4" wide x 10" long conforming to BICSI and TIA standards.
2. TGB shall be pre-drilled for bolts to secure bar to insulating standoffs. Mounting holes shall be 3/8" diameter spaced 5.75" apart. TGB shall include insulators to isolate busbars from the wall or other mounting surfaces.
3. Busbar shall be pre-drilled with hole pattern to accommodate two-hole lugs as follows, (4) lugs with 5/8" hole centers and (3) lugs, 1" hole centers.
 - a) Manufacturer CPI, Part No. 13622-010

B. Telecommunications Bonding Backbone (TBB):

1. Telecommunications Bonding Backbone conductors shall be 3/0 AWG stranded insulated copper conductor, unless otherwise noted.

C. Pipe Clamps:

2. Copper UL listed grounding connector with pre-drilled lug pad allowing 2-hold compression terminal; the size of connector will be dictated by pipe size.
 - a) Manufacturer Burndy, T&B, Thermoweld or approved equal.

D. Communication Grounding Rods:

1. Copper-clad steel, 5/8" x 9' long.
 - a) Manufacturer Burndy, T&B, Thermoweld or approved equal.

E. Exothermic Welding:

1. Manufacturer Erico Cadweld or Thermoweld, appropriate fittings as required.

F. C-type Compression Taps:

1. Bonding together two or more bonding backbones.
 - a) Manufacturer Burndy, T&B, Thermoweld or approved equal.

G. Cable Terminals:

1. Cable terminal shall be two-hole, non-insulated copper compression long barrel terminal, requiring 3/8" bolts on 1" and 5/8" centers.
 - a) Manufacturer Burndy, T&B, Thermoweld or approved equal.

2.09 WALL MOUNT RACKS AND CABLE MANAGEMENT

A. Pivoting Wall Rack

1. EIA compliant 19" wall mount rack shall have overall dimensions of 23.4" W x 49.06"H x 22"D. Weight capacity shall be 300 lbs.
2. Useable depth shall be 22" and shall extend into the back pan 3.5".
3. Center section and back pan shall be steel, phosphate pre-treated and finished in a black textured powder coat.
- 4.
5. Adjustable rackrail shall be constructed of 11-gauge steel with two 10-32 threaded holes per side of each marked rackspace, and a cage-nut style mount center hole that is compatible with tool-free Forward Series rackmount accessories.
6. Rack shall be constructed to swing open for component cabling access, center section shall pivot for either left or right opening.
7. Rack shall have a rear knockout panel with 1/2", 3/4", 1", 1-1/2", 2" and 3" electrical knockouts installed in base, and a rear knockout panel with 1/2", 3/4", 1", 1-1/2", 2" and 3" electrical knockouts, and BNC knockouts for UHF/VHF antennas installed in top.
8. Fan knockouts on top and bottom shall allow for installation of up to four 4-1/2" fans.

9. DWR Series enclosures shall satisfy the 2022 CBC; ASCE 7-16 (Chapters 13, 26 and 30) for use in areas of high seismicity, using an assumed Site Class D soil condition with lateral force requirements for protecting 155 lbs. of essential equipment in locations with the highest level of seismicity and top floor or rooftop installations with an Importance factor (Ip) of 1.5 when used with DWRSR-ZL Latch.
10. DWR Series shall be OSHPD approved for fixed equipment anchorage in California healthcare facilities.
11. Rack shall be GREENGUARD Gold Certified.
12. Rack shall be manufactured by an ISO 9001 and ISO 14001 registered company.
13. Rack shall be warrantied to be free from defects in materials or workmanship under normal use and conditions for 25 years
 - a) Manufacturer Middle Atlantic, Part No. DWR-24-22PD (door type Plexi glass)

B. Rack Mounted Cable Management:

1. Horizontal cable management panels shall distribution rings to secure copier and/or optical fiber patch cords.
 - a) Manufacturer CPI:
 - 1) 1RU panel with cover, Part No. 13930-701
 - 2) 2RU panel with cover, Part No. 13930-702

2.10 POWER DISTRIBUTION

A. Vertical Power Strips:

1. Equipment racks shall be equipped with the following. Quantities shall be provided as indicated on the Contract Drawings.
 - a) Vertical power strip shall be 33" vertically mounted power strip with (14) NEMA 5-20 receptacles and NEMA 5-20 plug.
 - 1) Manufacturer CPI:
 - a) Power strip, Part No. 12850-705
 - b) 9.1" mounting bracket, Part No. 35700-701 (per power strip)

B. Horizontal Power Strip:

1. Equipment racks shall be equipped with the following. Quantities shall be provided as indicated on the Contract Drawings.
 - a) Horizontal power strip shall be one rack unit in height with (8) NEMA 5-20 receptacles and NEMA 5-20 plug.
 - 1) Manufacturer CPI, Part No. 12816-705

2.11 TELECOMMUNICATIONS ROOM CONNECTIVITY

A. Patch Panels:

1. Augmented Category 6 Modular Patch Panels:
 - a) Augmented Category 6, 8-Position 8-Conductor module, non-keyed, dual reactance technology, 110 type printed circuit board style patch panels, universal T568A/B pin configuration standard and used to terminate UTP cables as specified herein. Patch panels shall be high density, 6-port modules, panel shall be 16-gauge steel with black painted finish; module shall be high impact plastic housing, flame retardant UL 94V-O, and fully encased protected printed circuitry. Modular contacts shall be beryllium copper, nickel under plating, 50 micro-inches of gold in contact area with IDC contacts phosphor bronze, nickel under plating with tin lead over plate, serving 22 through 24 AWG.
 - 1) Manufacturer Leviton:
 - a) 24 port patch panel, Part No. 6A586-U24
 - b) 48 port patch panel, Part No. 6A586-U48

B. Wall Mount 110 Series Wiring Block:

1. 110 wiring blocks shall be constructed of high impact fire retardant polycarbonate UL 94V-O molded plastic and shall contain extension legs. IDC contacts shall be phosphor bronze, 90/10 tin lead plating. Each kit shall include white horizontal identification strips that secure and organize 25 pairs each. For backbone cabling terminations, utilize 5-pair 110C connecting clips only. Each block shall include legs to allow back cable routing. The wiring blocks shall accommodate 22 through 26 AWG cable conductor size.
 - a) Manufacturer Leviton:
 - 1) Category 5e 100-pair backbone kit, Part No. 41AB2-1F5

C. Rack Mount Fiber Cabinets (RMFC)

1. Rack Mount Fiber cabinet shall be a termination and administration point for the optical fiber cables. Cabinets shall protect the connectorized optical fiber from mechanical stress, macro-bending loss at the connection point and tampering with the circuits.
2. Rack Mount Fiber Cabinets shall have a flush-mount bulkhead and shall be available in 1RU, 2RU, and 3RU versions to accommodate termination and splicing of fiber. Fiber panels shall have a flush-mount bulkhead and shall be available in 1RU and 3RU versions to accommodate termination of fiber. Adapter bulkhead shall accept SC, LC, ST, MTP®, and QUICKPORT™ adapter plates and plug-n-play MTP modules/cassettes. Fiber cable management for routing, storage, and protection shall be inclusive of patch cords, tight-buffer fiber, and backbone cables. Enclosures and panels shall be constructed of 16-gauge steel with a powder-coated black finish and be mountable in a 19-inch rack or cabinet frame.
3. Manufacturer Leviton:
 - a) 1RU Enclosure, Empty, Part No. 5R1UL-F03
 - b) 2RU Enclosure, Empty, Part No. 5R2UL-F06

D. Optical Fiber Adapter Panels

1. Optical fiber adapter panels shall be located within surface mount and rack mount fiber cabinets. Panels shall securely lock into open positions with the patching frames. Panels shall have plunger / grommet fasteners.
 - a) Optical fiber adapter panels shall consist of ST, LC or SC connector types and shall be configured in either simplex or duplex connector arrangements and indicated in the Contract Documents.
 - b) Unfilled positions within the fiber cabinets shall contain blank panels.
 - 1) Manufacturer Leviton:
 - a) Blank adapter panel, Part No. 5F100-PLT
 - c) Singlemode optical fiber connectors shall be in the color blue with ceramic alignment sleeves.
 - 1) Manufacturer Leviton:
 - b) 6-Duplex LC SM, Part No. 5F100-2LL

2.12 OPTICAL FIBER CONNECTIVITY

A. Optical Fiber Fan Out Kits

1. Buffer tube fan-out kits shall provide the means of field-install connectors on 250 µm coated fibers. Indoor kits shall have a 900 µm fan-out assembly that is color coded to match the fiber color scheme. The fan-out assembly shall be 47-inches in length.

a) Manufacturer Corning:

- 1) 12-fiber kit, Part No. FAN-BT47-12

B. Fusion Splice Sleeves

1. Fusion splice sleeves shall provide protection for fusion splices in rack mount and surface mount fiber cabinets. Sleeves shall be heat-shrink style in 60mm length.

a) Manufacturer Corning, Part No. 2806031-01 (Qty. 50)

C. Singlemode Connectors

1. Field installable singlemode connectors shall be provided to terminate optical fiber cables from cable-to-cable, cable-to-equipment, or equipment-to-equipment. Singlemode connector shall contain a factory bonded fiber strand insert, ceramic ferrule and factory polished.
2. Connector shall be capable of mounting on 125-micron fiber. The connector shall meet IEC standards for repeatability and have a locking feature to the coupler and assure non-optical disconnect.
3. Singlemode connectors that are straight tip shall be identified with the color blue.
4. Angled polished connectors shall be identified with the color green.

a) Manufacturer Leviton:

- 1) LC, Part No. 49991-SLC

1. Field installable multimode connectors shall be provided to terminate optical fiber cables from cable-to-cable, cable-to-equipment, or equipment-to-equipment. Multimode connector shall contain a factory bonded fiber strand insert, ceramic ferrule and factory polished.
2. Connector shall be capable of mounting on either 0.9 mm-buffered fiber or 3.0 mm cordage. Connector shall meet IEC standards for repeatability and have a locking feature to the coupler and assure non-optical disconnect.

a) Manufacturer Leviton:

- 1) LC 50/125 laser-optimized multimode, aqua, Part No. 49991-LLC

2.13 OPEN CABLING SUPPORTS

- A. Accessories and mounting hardware shall be provided for securing supports to structure for a complete and working installation of open cabling supports. Supports shall comply with TIA requirements for structured cabling systems and pathway supports. Follow manufacturer's recommendations for quantity of cables supported.
- B. Hook & Loop Fasteners:
 - 1. Hook and loop fastener rolls shall be 0.5-inch in width. Shear strength for plenum hook and loop fasteners shall be 29 PSI. Hook and loop fasteners installed in plenum air spaces shall be UL Listed (plenum) and be in the color maroon.
 - a) Manufacturer Leviton, plenum, Part No. 43115-75P or equal
 - 2. Hook and loop fastener rolls shall be 0.5-inch in width. Shear strength for non-plenum hook and loop fasteners shall be 23 PSI.
 - a) Manufacturer Leviton, non-plenum, Part No. 43115-75 or equal
- C. Circular Cable Retainer:
 - 1. Cable retainers shall be of plastic material with rounded edges, plenum rated, utilizing an easy-lock closure and an attachment base. Cable retainers shall be screwed into structure and only be utilized in spaces that are extremely tight and J-hooks do not have sufficient space to be mounted.
 - a) Manufacturer Erico Caddy, Part No. CAT CR50
- D. J-Hooks:
 - 1. J-hooks shall have a Galvanized finish with rounded edges for smoother cable pull and greater corrosion resistance.
 - a) Manufacturer Erico Caddy:
 - 1) 1" Dia., Part No. CAT16HP
 - 2) 1-5/16" Dia., Part No. CAT21HP
 - 3) 2" Dia., Part No. CAT32HP
- E. Adjustable Cable Support:
 - 1. Adjustable cable supports shall be of steel and polyethylene, plenum rated, with unlocking and locking bar allowing additional cables to be added easily after installation.
 - a) Manufacturer Erico Caddy, Part No. CAT425

F. Conduit Waterfalls:

1. Waterfalls shall be of glass reinforced flame retardant nylon 6.6 and UL Listed for air handling spaces (plenum).
2. Waterfalls shall be provided at the ends of 4-inch conduits and conduit sleeves installed horizontally where the pathways transition from conduit to ladder rack and cable tray pathways. Waterfalls shall be utilized to provide bend radius of all horizontal and backbone cabling.
 - a) Manufacturer Panduit, Part No. CWF400

2.14 CABLE PROTECTIVE DEVICES

A. Spiral Wrap:

1. Spiral wrap shall provide protection for cabling in exposed casework and/or furniture. Spiral wrap shall accommodate cable bundles from 3/8-inches – 4-inches and be in the color yellow.
 - a) Manufacturer Panduit, Part No. T50F-C4Y

B. Split Duct:

1. Split duct shall provide protection for cabling from the modular furniture feed-through point devices to the modular furniture base channel. Split duct shall have a 1.88-inch inside diameter and a 2.17-inch outside diameter and be in the color black.
2. Manufacturer Panduit, Part No. CLT188F-C20 (per 100'-0" roll)

C. Firestopping putty shall be a one-part, two-stage intumescent, non-hardening compound. The putty, when exposed to high heat or flame shall be capable of expanding a minimum of five times. Range of continuing expansion shall be from 230°F to >1,000°F (110°C to >538°C). The putty shall be soft and pliable with aggressive adhesion and shall not contain any water-soluble intumescent ingredients. The putty shall be UL Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479).

1. Manufacturer Specified Technologies, Inc. SpecSeal:
 - a) 24" putty bar, Part No. SSP28
 - b) 36" putty bar, Part No. SSP100

2.15 MATERIAL PROVISIONS

- A. Materials shall be provided to the Owner as specified herein. Deliver to the Owner Representative 21 days prior to Substantial Completion. Include a signed transmittal to the Owner or Owner's Representative for each type of patch cord, quantity, length, and color provided as part of the Final Acceptance.

1. Copper Patch Cords

a) Augmented Category 6 Patch Cords

- 1) Patch cords shall be constructed from Augmented Category 6 4-pair 23 AWG, stranded patch cable material.
- 2) Patch cord cable assembly shall be UL[®] listed and shall meet FCC Part 65 plug and termination.

Item	Manufacturer	Part Number	Qty	Length	Color	Description
1	Leviton	6AS10-3L		3'-0"	Blue	Data
2	Leviton	6AS10-5L		5'-0"	Blue	Data
3	Leviton	6AS10-7L		7'-0"	Blue	Data
4	Leviton	6AS10-10L		10'-0"	Blue	Data
5	Leviton	6AS10-7W		7'-0"	White	Workstation
6	Leviton	6AS10-10W		10'-0"	White	Workstation
7	Leviton	6AS10-3B		3'-0"	Black	Data
8	Leviton	6AS10-5B		5'-0"	Black	Data
9	Leviton	6AS10-7B		7'-0"	Black	Data
10	Leviton	6AS10-10B		10'-0"	Black	Data
11	Leviton	6AS10-3Y		3'-0"	Yellow	Data
12	Leviton	6AS10-5Y		5'-0"	Yellow	Data
13	Leviton	6AS10-7Y		7'-0"	Yellow	Data
14	Leviton	6AS10-10Y		10'-0"	Yellow	Data
15	Leviton	6AS10-3R		3'-0"	Red	Wireless
16	Leviton	6AS10-5R		5'-0"	Red	Wireless
17	Leviton	6AS10-7R		7'-0"	Red	Wireless
18	Leviton	6AS10-10R		10'-0"	Red	Wireless

2. Optical Fiber Patch Cords

a. Multimode Patch Cords (OM3)

- 1) Optical fiber patch cords shall be 50/125 μ m with metal ferrules, constructed from OFNR rated dual fiber cordage, in the color aqua.

Item	Manufacturer	Part Number	Qty	Length	Color	Description
1	Leviton	62DLC-M01		1M	Orange	LC – LC
2	Leviton	62DLC-M02		2M	Orange	LC – LC
3	Leviton	62DLC-M03		3M	Orange	LC – LC

Item	Manufacturer	Part Number	Qty	Length	Color	Description
1	Leviton	5LDLC-M01		1M	Aqua	LC – LC
2	Leviton	5LDLC-M02		2M	Aqua	LC – LC
3	Leviton	5LDLC-M03		3M	Aqua	LC – LC

Item	Manufacturer	Part Number	Qty	Length	Color	Description
1	Leviton	UPDLC-S01		1M	Yellow	LC – LC
2	Leviton	UPDLC-S02		2M	Yellow	LC – LC
3	Leviton	UPDLC-S03		3M	Yellow	LC – LC

2.16 GENERAL

- A. Include labor, materials, tools, equipment, and services for installation as indicated on the Contract Documents.
- B. Coordinate Work with other trades for complete and operational system.
- C. Include supplementary and miscellaneous items, appurtenances, and devices incidental to and necessary for sound, secure, and complete installation, whether or not specifically indicated in the Contract Documents.
- D. Provide suitable barriers and take any other safety precautions required by applicable codes.
- E. Work area shall be kept free from debris of all types and remove all rubbish resulting from their work on the premises. Upon completion, vacuum and clean room floors, equipment racks, enclosures and cable management where work has been performed.
- F. Contractor shall be responsible for any building repairs made necessary by their work or caused by negligence of their employees. No cutting, notching, drilling or altering of any kind shall be done to the building without first obtaining permission from the Owner.
- G. Owner may have other contracts in connection with this work for the installation of software and equipment. Contractor shall provide other Trade Contractors reasonable opportunity for the introduction and execution of their work and shall properly coordinate other trade's work with theirs as required.
- H. Provide patch panels and blocks indicated on the telecommunications drawings whether or not they are fully populated with cables.
- I. Provide cables, devices and equipment racking systems as indicated on the Contract Drawings.

2.17 TELECOMMUNICATIONS ROOM EQUIPMENT INSTALLATION

- A. Primary function of a telecommunications room is the termination of horizontal, backbone and service entrance cabling to compatible connecting hardware.
- B. Telecommunications room also provides a controlled environment to house telecommunications equipment, connecting hardware, and splice enclosures serving a portion of the building.
- C. Install fire retardant plywood backboard vertically at 6" AFF painted with white latex paint as indicated on drawings. Backboard shall be painted to leave fire seal exposed. See Contract Drawings for location of backboards in the telecommunications rooms and spaces.
- D. Provide equipment including the following, but not limited to the following, and shall be installed according to the Contract Drawings:
 - 1. Equipment racks and enclosures with cable management systems
 - 2. Cross-connect patch panels and termination blocks, whether they are populated or not
 - 3. Telecommunications workstation devices
 - 4. Cable tray and ladder rack
- E. Where applicable, each freestanding equipment rack and/or server enclosure shall be seismically braced from the top to a structural component beam, column, bearing wall, etc. of the building. AHJ shall determine if seismic bracing is required and if structural engineering services are required.
- F. Equipment rack shall be secured to the concrete floor with a concrete floor mounting kit.
- G. 110 blocks shall be securely fastened to the backboards in the telecommunications room. Provide all required D-rings or other approved cable guides as identified on the Contract Drawings.

2.18 LADDER RACK INSTALLATION

- A. Install ladder rack at locations indicated on the drawings. Installation shall be in accordance with manufacturer's instructions and with recognized industry practices to ensure that ladder rack equipment comply with requirements of NEC and applicable portions of NFPA 70B. Reference NEMA-VE2 for general cable tray installation guidelines.

- B. Support the ladder rack on 5' centers for a total of 2 supports for every 10' span when the ladder rack is supported from the ceiling. Support ladder rack at every transition. Support ladder rack utilizing wall mount brackets or c-channel hangers.
- C. Provide additional brackets on ends, and two additional brackets at tees and corners. Securely fasten ladder rack to brackets and supports using clamps manufactured for the purpose. Provide all required hardware and supports.
- D. Fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.

2.19 OPEN CABLING SUPPORT INSTALLATION

- A. Cabling shall be run exposed as "open cabling" in accessible ceiling spaces and accessible ceiling plenums, unless otherwise noted. Where ceiling spaces are inaccessible or open to structure cabling shall be routed in conduit.
- B. Provide all hanger supports and cable supports for cabling specified in this section. All support structures shall adhere to the requirements in the National Electrical Code.
- C. Cabling supports shall be spaced no further than 4'-0" apart.
- D. Cabling bundles shall not sag a maximum of two inches from the bottom of the cable support.
- E. Provide all additional cable management products as required to protect exposed cabling and complete the installation of cabling in a neat professional manner.
- F. Floor penetrations shall be at columns, exterior walls unless otherwise specified.
- G. Cabling supports shall be installed on their own support system. The use of ceiling grid supports shall be prohibited.
- H. Do not support cables from ductwork, sprinkler piping, water piping, waste piping, conduit or other system supports. Cabling shall never come in physical contact with these mechanical, fire protection and electrical systems and raceways.
- I. Cabling bundles and supports changing pathway direction shall maintain proper bend radius as to not impact the physical jacket construction of the cabling. Cabling that becomes damaged during this transition shall be replaced in its entirety.
- J. Follow manufacturer's recommendations for quantity of cables supported in J-hooks and adjustable cable supports.

- K. Installers shall observe the applicable requirements and recommended good practices contained within TIA-568-C standard for cabling installation requirements.

2.20 CABLING INSTALLATION

- A. Telecommunications devices shall be connected to the horizontal cross-connect in a telecommunications room with horizontal cabling installed in star topology.
- B. Horizontal cabling shall be installed in continuous runs from the telecommunications rooms to telecommunications device locations. Splices are not permitted.
- C. Maximum length of horizontal cables shall be 295 feet (90 m) including all service loops.
- D. Cabling shall be installed in accordance with manufacturer's recommendations, including but not limited to maximum tensile loading and maximum bend radius.
- E. Cabling shall be organized and identified to facilitate locating and handling individual sheaths for maintenance functions.
- F. Bundles shall be neatly secured without cinching or stressing the cabling, using hook and loop fasteners in open cabling installations and in the telecommunications room. Hook and loop fasteners shall be loose enough so that the fastener can be easily rotated around the cabling bundle and does not impact the physical construction of the cabling.
- G. Provide machine typed label on both ends of the horizontal cabling jacket no more than 4-inches from each termination point.
- H. Great care shall be taken to protect all cabling from physical damage beneath floors, above ceilings or elsewhere. Cabling shall not be exposed to any forces or handling factors that will degrade performance, such as crushing, pull stressing, twisting, or damaging sheathing materials. When left unattended, all cabling shall be secured and protected to avoid damage.
- I. Hook and loops fasteners shall be utilized in the telecommunications room for all cabling bundles. Tie wraps are prohibited in the telecommunications rooms and spaces.
- J. A spare pull string shall be installed at every outlet installed.
- K. Horizontal and backbone cabling shall be bundled and routed separately in dedicated cabling supports in a neat and organized fashion for routing from the telecommunications rooms utilizing cable trays and open cabling pathways to the telecommunications devices.

- L. Route cabling runs from workstations parallel to building grid lines and directly to open cabling pathways without passing over adjacent office spaces or cubicles.
- M. Provide 5 feet of slack in neatly suspended loops above each workstation and 10 feet of slack neatly coiled in the ladder rack or cable tray in the telecommunications room unless indicated otherwise on Contract Drawings. Service loops in the telecommunications room shall not be located above the equipment racks and server enclosures.
- N. Cables shall contact only dedicated and properly protected cable accesses and support mechanisms.
- O. Telecommunications unshielded twisted pair cabling supported utilizing open cabling methods shall maintain a minimum separation of three inches from fire alarm, intercom/paging, clocks, and security cabling. Cabling supports shall maintain increased separation requirements when attaching to the same hanger rod to ensure cabling sag maintains the minimum three-inch separation.
- P. Maintain the following distances between cabling and other building systems:
 - 1. One foot from fluorescent lights.
 - 2. Six feet from motors and transformers.
 - 3. Three feet from water piping or other mechanical equipment.
 - 4. One foot from electrical conduits or other electrical equipment.

2.21 CONNECTIVITY AND CABLING INSTALLATION

- A. Cabling shall be dressed and terminated in accordance with the cabling installation requirements identified in TIA-568-C, BICSI Telecommunication Cabling Installation Manual, and the manufacturer's documentation.
- B. Cabling entering the telecommunications room and routing on the ladder rack or cable tray pathway shall be separated into cabling bundles specific to the patch panel in which it will be terminated to. Cable bundles shall be in increments of 24 cables.
- C. Cabling shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the equipment rack, enclosure, or backboard.

- D. Cabling transitioning from ladder rack or cable tray pathway shall maintain proper bend radius utilizing waterfall device brackets for transitioning vertically down the side rail of an equipment rack or server enclosure as to not impact the physical jacket construction of the cable. Waterfall device brackets shall also be utilized for transitioning cabling to blocks mounted on plywood. Cabling that become damaged during this transition shall be replaced in their entirety.
- E. Cabling shall terminate from one side of each patch panel only. The cabling shall terminate from the alternate side for the next patch panel position below the previous patch panel termination and shall continue in this orientation for the entire duration of the number rack units per equipment rack.
- F. Cables shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support straps. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.
- G. Installation of 8-position 8-conductor modular jacks into faceplates and attaching of the faceplates to the wall shall ensure that the faceplates are flush. The faceplate shall be secured to the wall but shall not be secured to the wall with such force as to bow the faceplate.

2.22 WORK AREA

- A. 4-pair UTP horizontal cabling shall be terminated on an 8-position 8-conductor modular jack or plug at each telecommunications device as indicated on the applicable Contract Drawings.
- B. Telecommunications devices shall be provided with 8-position 8-conductor modular jacks or plugs in the quantity as indicated on the applicable Contract Drawings.

2.23 CABLING TERMINATIONS

- A. Provide all necessary installation materials, tools and equipment to perform insulation displacement type terminations at all the telecommunications outlets, patch panels and 110 cross-connect blocks.
- B. Pairs in each cable shall be terminated on a 110 block, modular patch panel or telecommunications modules in accordance with this specification.
- C. Cabling shall be terminated in accordance with the T568B pin configuration standard.
- D. Remove only as much of the cable sheath as is necessary to terminate the cabling on the connecting hardware.

- E. A maximum of 0.25" of cable pair twists shall be removed from a 4-pair UTP cable. Cabling and terminations exceed these dimensions shall be re-terminated.
- F. At the horizontal station patch panel, the cabling shall terminate from the center of the 110 IDC termination.
- G. Terminate cabling in accordance with connecting hardware manufacturer's recommendations. All cabling shall terminate in numerical sequence.

2.24 FIRESTOPPING

- A. Firestop systems shall be installed in accordance with the NEC and the manufacturer's recommendations and shall be accomplished in a manner acceptable to the local fire and building authorities having jurisdiction over this work.
- B. Cabling running through rated floors and walls shall be firestopped in accordance with the requirements within this Section.
- C. Penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure).
- D. Penetrations created by or for the contractor and left unused shall also be sealed as part of the contractor's scope of work.
- E. Firestop putty or pillows shall be used inside conduits and cable trays to provide a re-enterable system allowing telecommunications cables to be easily removed or added in the future. Firestop putty shall not be water soluble.
- F. Firestop systems shall be UL Classified to ASTM E814 (UL 1479).
- G. Firestopping sleeved devices shall be installed according to the manufacturer's recommendations including, but not limited to;
 - 1. Wiring devices shall be installed in locations where indicated on the Contract Drawings, arranged in a single or multiple sleeve formation at the height specified. Sleeves shall be installed a minimum of 6 inches above the accessible ceiling grid.
 - 2. Install the devices in strict accordance with the approved shop drawings and the manufacturer's recommendations.
 - 3. Apply the factory supplied gasket material prior to the installation of the wall plates.

4. Secure wall plates to devices per the equipment manufacturer's recommendations.

2.25 TELECOMMUNICATIONS GROUNDING AND BONDING

- A. Grounding and bonding connections to the building's structural steel, electrical service main building ground and telecommunications bonding backbone shall be terminated on the left side of the busbar to facilitate access for other grounding sources within the space to be terminated within the center and right side of the busbar.
- B. Bonding backbone shall route along the shortest and straightest pathway as possible with minimal bends. Any bend shall be sweeping. The conductors shall be continuous and shall not contain splices.
- C. Telecommunications bonding backbone shall connect the main telecommunications grounding busbar to each other telecommunications grounding busbar within the facility.
- D. Grounding and bonding conductor distances shall meet the distance requirements described within TIA-607-C.
- E. Grounding and bonding connections shall be a stranded, insulated copper conductor with a minimum size of #6 AWG.
- F. Grounding and bonding connectors shall be 2-hole and made with a crimp or other non-reversible termination method.
- G. Provide a coupled bonding conductor for outside plant copper shielded cabling routing between buildings and ground to the busbar.
- H. Provide grounding and bonding of each building entrance protection block.
- I. Provide a dedicated grounding connection for the below floor and overhead ladder rack and/or cable tray pathways.
- J. Equipment racks and server enclosures shall have a dedicated grounding connection.
- K. Provide grounding and bonding of all telecommunications pathways including conduit raceway systems and ladder rack pathways.
- L. Ensure that all grounding and bonding connections break through and/or remove the paint to the bare metallic surface of all painted metallic hardware.

2.26 INSTALLATION OF TEXTILE INNERDUCT

- A. Flexible textile innerduct shall be installed in compliance per manufacturer written instructions.
- B. Utilize manufacturer required installation swivels and harnesses.
- C. Tie off innerduct spines and pull strings within each maintenance hole on the side racking and just below the ladder rack or cable tray within the telecommunications rooms. Provide a separate tie off device mounted securely to the plywood backboard in the telecommunications room. Utilizing the overhead ladder rack or cable tray is prohibited as a tie off connection for the innerduct.
- D. Maintain innerduct color code identification schemes and cable tie labeling throughout the entire outside plant duct bank pathway system.
- E. Cells shall have a specific color and identification tag label, where the cell is a spare or has cabling installed within.
- F. Ensure the innerduct does not spiral during installation. Innerduct shall be hand guided from the reel, maintenance hole openings and into the assigned underground conduit.
- G. Provide inflatable installation kits for water and moisture blocking for conduits where the innerduct has been installed within the service entrance maintenance hole, service entrance exterior junction box and telecommunications rooms.
- H. Pull strings shall be maintained unused in spare innerduct cells.

2.27 INSTALLATION OF OPTICAL FIBER CABLING SYSTEM

- A. Installation for Optical Fiber Cabling:
 - 1. Follow cable manufacturer's specifications regarding handling methods, bend radius and maximum pulling tension limitations.
- B. Securing Fiber Cabling:
 - 1. Immediately after cabling installation, a permanent identification tag as indicated shall be attached to visible cabling sections. Cabling shall be checked to ensure that the markings are intact.
 - 2. Cabling and equipment shall be supported and secured as indicated. Where the specific method of support is not indicated, supports and fasteners shall be used to secure cabling and equipment in position. Metallic supports and fasteners shall have a corrosion resistant finish. All cabling shall be routed along the interior sides of manholes.
 - 3. Corrosion resistant clamps and straps shall be used as necessary to properly secure the cabling.

4. Optical fiber cabling shall be secured to the optical fiber cabinet using the aramid strength yarn of the cabling to provide strain relief.

C. Optical Fiber Cabling Bending:

1. Caution shall be used when bending cabling to avoid kinks or other damage to the sheath. Bend radius shall be as large as possible with a minimum of 20 times the cabling diameter. Minimum radius shall be increased when necessary to meet cable manufacturer's recommendation. Cabling shall not rest against any sharp edges.

D. Optical Fiber Cabling Pulling:

1. Pulling lines shall be attached to both cable ends when cabling is destined for bi-directional pull and fitted with factory-installed pulling eyes where possible. Cabling not equipped with a pulling eye shall have the pulling line attached to the cable end by means of a cable grip. Core hitches shall not be used.
2. Cable reels shall be located and aligned so that the cable is payed out from the top of the reel by rotating the reel in the feed direction at the rate of pull into the duct or conduit in a long, smooth bend without twisting. Cabling shall not be payed out from the bottom of the reel or by pulling. A cable feeder guide of proper dimensions shall be used at the mouth to guide the cable into the duct or conduit.
3. Rigging shall be set up at the pulling end so that the pulling line and cable exit on a line parallel with the duct or conduit to prevent either from rubbing against the edge or mouth. Cable ends shall not be pulled around sheave wheels. When the sheave or pulley cannot be positioned to obtain sufficient cable end slack for proper racking and splicing with the pulling line attached to the end of the cable, a split cable grip may be used to obtain the necessary slack.
4. Equipment and the pulling set shall be checked to minimize interruptions once pulling begins. Cabling shall be payed out without stopping until the required amount of the cabling has been placed. If the pulling operation is halted before the pull is completed, the tension of the pulling line shall not be released. When pulling is resumed, the inertia of the cabling shall be overcome by increasing the tension in small steps a few seconds apart until the cabling is in motion.
5. Pulling tension shall not exceed 500 lbs. or cable manufacturer's recommendation, whichever is less.

6. Provide a 20' foot service loop for all optical fiber cabling located at both ends of the cabling run in all telecommunications rooms and in utility vaults. Service loop shall be attached to the fire-retardant plywood backboard and shall not be located on the ladder rack or cable tray.
7. Do not pull optical fiber cables with copper cables.
8. Do not pull optical fiber cables over existing cables.
9. When pulling optical fiber cabling in an innerduct or conduit, do not exceed the 40% fill ratio.

E. Optical Fiber Cabling Terminations:

1. Cable terminations shall be made in optical fiber distribution units. All installed optical fiber strands shall be terminated.
2. Optical fiber cabling terminations shall utilize enclosures and components in quantities consistent with the required fiber counts at each end of each segment. During optical fiber connector termination and polishing, visually inspect all terminations with a 400-power microscope. Follow all of the connector manufacturer's recommendations. Unacceptable flaws in the terminations will include, but not limited to, scratches, full or partial cracks, bubbles, pits, epoxy residual, dirt, dust, oil, moisture, grinding and sanding debris. The acceptable final polish will show a connector tip that is free of all imperfections in 100% of the core and 80% of the cladding. All unacceptable connectors shall be inspected after rework.
3. Optical fiber cabling slack shall be neatly coiled within the optical fiber cabinet. No slack loops shall be allowed external to the optical fiber cabinet.
4. Cables shall be clearly labeled at the entrance to the fiber adapter panel.
5. To maintain the correct polarity throughout the optical fiber cabling system, each cabling segment shall be installed in a pair-wise crossover orientation as defined in TIA 568-C.
6. Dust caps shall be installed on the connectors and couplings.

F. Optical Fiber Mechanical Splices and Trays:

1. Adhesive mechanical splices shall follow the manufacturer assembly process including stripping, cleaving, and inserting fibers, securing by invoking cam. Optical fiber strands shall be tuned during the assembly process insuring a low loss splice and mounted into optical fiber trays.
2. Optical fiber trays shall be mounted in surface and rack mount fiber cabinets, enclosures, and equipment racks, maintaining bend radius and in providing protection for optical fiber strands.

G. Bonding and Grounding Interlocking Armored Cable:

1. Bond interlocking armored optical fiber cable to the telecommunications grounding system.
2. A dedicated, UL listed #6 AWG stranded copper insulated bonding conductor shall be attached to the interlocking armor using a NEC approved clamp, lug or connector. Apply vinyl tape around the clamp, lug or connector and exposed armor to protect the installer and the optical fiber from any sharp edges where the armor is exposed.
3. Bond the other end of the bonding conductor to the Telecommunications Main Grounding Busbar (TMGB) or the Telecommunications Grounding Busbar (TGB) or a metallic enclosure bonded to a NEC recognized grounding system.
4. Bond and grounding of optical fiber cable interlocking armor shall be in compliance with the NEC and with the cabling and connectors/clamp manufacturers' installation instructions.

2.28 LABELING

A. General:

1. Labeling shall be in accordance with TIA-606-B, Administration Standard for Commercial Telecommunications Infrastructure.
2. Labels shall be permanent typewritten labels produced by a labeling machine.
3. Labels shall be installed on all cabling at each end. Ensure labels are securely fastened.
4. Labels shall be located within 6 inches of cable termination and placed so they can be easily read.
5. Font type for each type of label shall be Arial with maximum size font allowed.
6. Labeling information will be reviewed at the Pre-Construction Meeting.
7. Labeling shall be completed prior to the Substantial Completion date of the project.

B. Telecommunications Device Labeling:

1. Label shall be produced to fit into the recess provided and covered with a clear plastic cover.

C. Equipment Rack Labeling:

1. Plastic lamacoid nameplate shall be provided for each equipment rack in the IDF Room.
2. Plastic lamacoid nameplate shall be black with white letters. The nameplate shall be machine engraved with a size 36 font.
3. Mount the name plate at the top of each equipment rack or wall mount enclosure.
4. Labeling scheme shall be as indicated on the Contract Drawings.

D. Patch Panel Labeling:

1. Station Patch Panel
 - a) 48-port modular patch panels shall be labeled with sequential numbering starting with "01" for the topmost patch panel and moving downward to the bottom of the rack. Patch panel labels shall be affixed to the left-hand side of the patch panel.

E. Optical Fiber Termination Labeling

1. Labeling shall be placed within the designation strip holder of the fiber connector panel where designation strips are provided with the connector panel.
2. Labeling shall be placed on the inside of the front door for surface mount fiber cabinets and rack mount fiber cabinets where no designation label strips are provided. The label shall be in the same orientation of the connector panel.
3. Labeling shall contain the originating room designation, rack row if applicable, equipment rack number designation, rack mount fiber cabinet number, fiber adapter panel position(s) and the associated fiber strand numbers by individual strands and/or optical fiber subunit classification.

F. Backbone Optical Fiber Labeling:

1. Cable Identification Tag Labeling:
 - a) Optical fiber and copper backbone cabling shall be clearly and visibly identified by the Contractor in all vaults, pull boxes, pull points, entrance points, service entrance and 3' before entering a free-standing rack, rack-mounted enclosure, wall-mounted enclosure or surface mount fiber cabinet utilizing an optical fiber cable identification tag.
 - b) Optical fiber and copper backbone cable identification tags shall contain the following information at a minimum.

- 1) Cable manufacturer and part number
- 2) Extent of cable run (i.e., "From: MDF – To: IDF-X")
- 3) Cable type and description (i.e., "In/Outdoor Loose Tube, OM3 12-strand")

2.29 TESTING

- A. Test procedures shall be as prescribed by the TIA, Insulated Cable Engineers Association and the National Electrical Testing Association.
- B. Test Equipment:
 1. Network testing equipment shall be a Fluke Networks DSX-5000 Cable Analyzer or equal and shall have a certified calibration from the manufacturer within the past 12 months at the time of testing. Proof of calibration shall be provided with the product submittal. Test equipment shall be utilized to test horizontal and backbone cabling.
 2. Field tester and adapters shall be certified by an independent laboratory as meeting or exceeding current level as defined in TIA-1152 Level IIIe.
 3. 8P8C test plug for the network testing equipment adapters shall be in range of values defined in Annex C with TIA-568-C.2 for Near-end Crosstalk, Far-end Crosstalk and Return Loss.
 4. Test equipment shall support the complete suite of Resistance Unbalanced standards for PoE per IEEE 802.3af, IEEE 802.3at and TIA-568-C.2.
 5. Test equipment shall be able to test up to a 1000 MHz frequency range.
 6. Test equipment shall be ISO 9001 certified.
 7. An electronic copy of the manufacturer's testing procedures shall be kept in the job site office.
 8. Test equipment batteries shall be charged daily and a level of greater than twenty-five percent of capacity shall be maintained during the testing.
 9. Test equipment shall be calibrated daily before the start of testing.
- C. Horizontal Cabling:
 1. Horizontal cabling shall be certified to meet or exceed the permanent link performance specifications for Category 6A horizontal cabling tested as defined in TIA-568-C.2.
 2. Certifications shall include the following parameters for each pair of each cable installed:

- a) Building identification
 - b) Cable identification
 - c) Date of test
 - d) Test equipment manufacturer and model number
 - e) Wire map
 - 1) Continuity to the remote end.
 - 2) Shorts between any two or more conductors
 - 3) Reversed pairs
 - 4) Split pairs
 - 5) Transposed pairs
 - 6) Any other miswiring
 - f) Length
 - g) Near-end crosstalk (NEXT)
 - h) Attenuation to crosstalk ratio far-end (ACRF)
 - i) Power sum Attenuation to crosstalk ratio far-end (PSACRF)
 - j) Power sum-near-end crosstalk (PS-NEXT)
 - k) Return loss (RL)
 - l) Propagation delay (PD)
 - m) Delay skew (DS)
3. Horizontal cabling shall be tested using a Permanent Link configuration as defined in TIA-568-C.
 4. Test reports with an asterisk (*) or fails, shall be documented identifying the reason for the test failure and a corrective action plan developed.
 5. After corrective action has been completed, the permanent link shall be retested.
 6. It is the Telecommunications Contractor's responsibility to ensure 100 percent of the network horizontal cabling system links pass all tests.
 7. Test results shall be organized by building identification and cable identification number. The test results shall contain the date and time of when each test was saved in the memory of the tester. The test results shall be recorded on a flash drive in both PDF and LinkWare software formats.

D. Optical Fiber:

1. Acceptance Testing

- a) Optical fiber test jumper shall be properly cleaned at both ends prior to the start of testing for each backbone segment.
- b) A reference power measurement shall be obtained by connecting one end of test jumper 1 to the light source and the other end to the power meter tester. After recording the reference power measurement, test jumper 1 shall be disconnected from the power meter tester without disturbing the light source and attached to the cable plant. The power meter tester shall be moved to the far end of the cable plant and attached to the cable plant with test jumper 2.
- c) Multimode optical fiber attenuation shall be tested and recorded at a minimum of three times on all individual fiber strands of each cable using the power meter tester configuration to determine the actual loss and the connector repeatability. Each of the three tests shall be recorded and a final value with the average of the three tests shall also be recorded. The connector repeatability shall not exceed 0.2 dB as defined by Telcordia GR-326-CORE. These tests shall be performed at the 850nm and 1300nm windows in bi-directional testing. Test set up and performance shall be in accordance with TIA/EIA-526-14A, Method B, and TIA-568C.0.
- d) After terminating optical fiber cabling, one of the individual fibers of each cable segment shall be tested using an OTDR to determine the actual length. One strand of each optical fiber buffer tube shall be tested with an OTDR.

2.30 WIRELESS ACCESS POINTS

- A. Wireless Access Points shall be Owner-Furnished Owner-Installed.

2.31 PATCH CORD INSTALLATION SUPPORT

- A. Provide installation of the copper and optical fiber patch cords between the active network electronics and horizontal station patch panels.
 - 1. Coordinate with the District for patching and switch requirements.
 - 2. Contractor shall request the port identification patching matrix from the District in writing a minimum of three weeks in advance of starting the patch cord installation.

- B. Patch cords shall be routed in a neat and orderly fashion, maintaining proper bend radius of the patch cords as to not decrease the system performance. Utilize horizontal and vertical cable management, including all bend radius support attachments to their fullest extent.
- C. Horizontal cable management panels that contain small retainer clips at the top and bottom of the panels, a maximum of three patch cords shall be held within the retainer clips when interconnecting into patch panels or network switch ports.
- D. Patch cords with sufficient length shall be utilized as to not damage or stretch the cable jacket but the lengths shall not be more than 18 inches in excess length stored within the vertical cable management.
- E. Patch cords shall be routed horizontally in the cable management panels and transition upward and downward within the vertical cable management sections. Patch cords shall not be dressed top to bottom on the fronts of the equipment racks.
- F. At the completion of the patch cord installation, provide an updated port identification patching matrix, in Microsoft Excel format, indicating the network switch number, switch blade number and switch port number that the patch cords interconnect occurred from the horizontal station patch panel. Provide a column indicating specific function uses of the switch port such as Voice-Over-IP, wireless, streaming video and IP intercom/clock. Coordinate the specific function identifications and classifications with the Owner and Owner's Representative prior to the start of the installation. In addition, for voice cross-connects, indicate the voice cross-connect patch panel number and port that the patch cord cross-connect occurred from the horizontal station patch panel. For voice cross-connects, indicate if the port is for analog or digital use.

END OF SECTION

SECTION 27 4100
CLASSROOM AUDIO VISUAL SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. System Description

1. Provide a Classroom Audio Visual system and other relevant components and accessories required to provide a complete operating system as specified herein.

B. General Requirements

1. Drawings and general provisions of the Contract, including General Supplementary Conditions, Division 01 sections and Section 260501 apply to the Work in this Section.

1.02 RELATED SECTIONS

A. Related Sections

1. 26 0501 – General Electrical Requirements
2. 26 0533 – Raceway and Boxes for Electrical Systems
3. 27 1000 – Telecommunications System
4. 27 5123 – IP Intercom Clock System

1.03 QUALITY ASSURANCE

- A. The system and its components shall be Underwriters Laboratories (UL) listed under the appropriate UL testing standard as listed herein for audio visual applications.

B. Codes and Standards:

1. American National Standards Institute (ANSI):
 - a) ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
2. Federal Communications Commission (FCC):
3. Title 47 CFR – Part 15; Class B – Radiated and Conducted Emissions.

4. Underwriters Laboratories, Inc. (UL):
 - a) UL 50 – Enclosures for Electrical Equipment.
 - b) UL 60950-2 – Information Technology Equipment.
5. California Electric Code (CEC): Latest Version
6. National Electric Safety Code (NESC): Latest Version
7. Department of Justice (DOJ): 2010 ADA Standards for Accessible Design
8. Provide all wiring in accordance with Article 725 of the National Electrical Code and local ordinances, and other sections of these specifications.

C. Qualifications

1. Audio visual system equipment shall be supplied and installed by an authorized Extron installer. The contractor shall have furnished and installed similar systems continuously for no less than five (5) years.
2. Contractor shall be certified as an AV Associate, receive factory training for major specified audio visual components, including but not limited to; audio enhancement systems, wireless microphones, audio visual switcher, controller and hardware installations. Certifications shall be submitted as part of the product submittals.
3. Installation shall be made by a licensed and bonded contractor holding a valid California State Electrical Contractor's License.

1.04 SUBMITTALS

A. General

1. Submit listed submittals in accordance with "Conditions of the Contract".

B. Product Data

1. Submit with data arranged under basic categories, such as, certifications, personnel training, manufacturer warranty, products, test equipment and calibration, and similar items. Include index with the submittals.
2. Organize by specification infrastructure component sections.
3. Submit product data information sheets with item and model number.
4. Where more than one product is shown on a page, mark product with arrow or by other means to identify exact product or products being submitted by specific part number.

5. Submit resumes and certifications of technicians and project manager who will support this project. Certifications shall include:
 - a) Manufacturer's certification to provide warranty.
 - b) Approved manufacturer classes satisfactorily completed.

C. Shop Drawings

1. Provide drawings with details of proposed system including equipment and work to be performed. Drawings shall include point-to-point connections and wiring diagrams of individual devices.
2. Provide connections to other equipment or systems not specified herein.
3. Drawings shall include short-throw video projector (OFCI) mounting heights based on the whiteboard installation height. Where multiple whiteboard heights exist, provide heights for each.

D. Acceptance Test Plan

1. An acceptance test plan form shall be prepared and provided by the contractor.
2. This form shall include separate sections for each device and a column indicating the result of the testing performed by the contractor (pass/fail), and an empty column for recording findings during the walk-through.

E. Record Drawings

1. Keep complete set of Classroom Audio Visual System drawings in job-site office to show actual installation of cabling and equipment during construction. Use this set of drawings for recording as-built conditions. Indicate where material, equipment, and system component are installed differently from that shown on the contract drawings.
2. Prepare electronic set of Record Drawings, incorporating changes during construction. Submit Record Drawings to Owner's Representative for review and acceptance.
3. Submit Record Drawings using latest version of AutoCAD software or as approved by the Owner, and in PDF format. Request final architectural background drawing files.
 - a) AutoCAD drawings shall be e-transmitted to include backgrounds, title blocks and other associated files.
4. Submit electronic copy of Record Drawings in full-size PDF and AutoCAD format, on flash drive.

F. Project Closeout

1. Submit closeout documentation to the Owner's Representative and Architect under provisions of Division 01, Division 26 and this section.
2. Provide all project closeout documentation including but not limited to; test acceptance documentation, Record Drawings, manufacturer's warranty and Operation and Maintenance Manuals.

1.05 OWNER FURNISHED CONTRACTOR INSTALLED (OFCI) EQUIPMENT

A. Material Handling and Delivery

1. Coordinate delivery of OFCI equipment. Receive, off load, transport, store, hoist, unpack, dispose of packing, same as for other project equipment arriving at job site. Requirements of the Contract Documents apply to OFCI equipment.

B. Operation and Maintenance Data

1. Obtain from the Owner operation and maintenance data for the OFCI equipment and incorporate into the Operations and Maintenance Manuals.

1.06 SYSTEM REQUIREMENTS

- A. Owner to provide Ethernet network connectivity for all devices required by Extron in order to fulfill the warranty. The installed devices and cabling in the system shall be guaranteed for a period of three years from the date of shipment.

1.07 MATERIAL PROVISIONS

- A. Deliver materials to the Owner under provisions of this section.
- B. Contractor shall be responsible to provide a material transmittal for all materials being provided to the Owner as described herein and that are not permanently installed. Transmittal shall be signed by the General Contractor and the Owner receiving the materials. Transmittal shall be included as part of the Operations and Maintenance Manuals.

PART 2 - EQUIPMENT

2.01 CLASSROOM AUDIO VISUAL SYSTEM

- A. Provide all labor and materials as specified herein for a complete and operational Classroom Audio Visual System.
- B. Materials shall be new and free from defects.

1. Manufacturer Extron:
 - a) PlenumVault Mounting Kit PVM 220 for ultra short-throw video projector.
- C. Provide the following components for Classroom Audio Visual System.
 1. IP Enabled Digital AV Switcher with Integrated Audio Amplifier.
 - a) AV switcher shall be a digital seven input (4-twisted pair, 2-HDMI and 1-audio), twisted pair switcher with integrated stereo audio amplifier. Audio and video signals shall be balancing and isolation to prevent any superfluous noise or signal. Digital audio and video signal shall be distribution inputs from the audio visual outlets connected with shielded foiled twisted pair (S/FTP) cabling.
 - 1) Audio video switcher, Extron Part No. PVS 407D
 2. Audio Visual Outlets
 - a) Audio visual outlets shall be connected to the AV switcher utilizing S/FTP cable and shielded RJ-45 connectors.
 - 1) Dual HDMI and stereo audio input wallplate (AV1):
 - a) Extron Part No. PVT HDMI
 3. Audio Visual Controller
 - a) Controller shall provide for the control of speaker volume, video input selection and display power on / off. Controller shall be connected to the AV switcher utilizing power / RS-232 cable and IR / RS-232 cable to the video projector or display monitor.
 - 1) Extron MLC Plus 200, Part No. 60-1470-02
 4. Speakers – Lay-in Ceiling
 - a) Speakers shall be a complete loudspeaker assembly, including back box, and be designed for drop-ceilings. Cabling shall be minimum 18 AWG. Speaker shall be flush mounted – full range speaker system to provide clear and natural sound. Speakers shall be mounted in the ceiling tile grid and be provided with all mounting and support hardware to avoid any sagging of the ceiling tile.
 - 1) Flat field (1-pair), Extron Part No. FF120T
 5. Ceiling Mounted Enclosure

- a) The enclosure shall fit on a 24 by 24 inches framed tile space and shall be used to mount a PoleVault System switcher and the power supply, and other AV equipment.

- 1) Manufacturer Extron Part No. PVM 220

6. Page Sensor

- a) Page sensor shall automatically mute classroom audio during an announcement from a public address or intercom system. Sensor mounts to the face of any PA speaker and detects when audio is present, signaling the switcher to mute the classroom audio for the duration of the announcement.

- 1) Priority page sensor, Extron Part No. PPS 35

2.02 WIRELESS MICROPHONE

- A. High performance wireless microphone shall utilize digital transmission and pairing in a dedicated spectrum to provide superior performance and include receiver with 3' shielded cable, (1) pendant microphone, (1) handheld microphone and (1) charging station. Receiver shall support up to two microphones and two relays for triggering events.

- 1. Manufacturer Extron, VoiceLift Pro VLM 3002H, Part No. 42-255-03

2.03 ULTRA SHORT THROW VIDEO PROJECTOR AND MOUNT

- A. Ultra short throw video projector and mount shall be Owner-Furnished, Contractor-Installed (OFCI). Image shall be projected onto a standard whiteboard. Video projector installation, testing, and training shall be provided by the Contractor.
- B. Contractor shall provide pre-installation calculations for mounting heights based on Owner-furnished video projector prior to conduit rough-in.

2.04 CABLING AND CONNECTIVITY

- A. Digital Audio Visual Cabling & Connectivity
 - 1. Where bulk cabling is used for the installation of digital audio visual devices, the cabling shall be SF/UTP terminated on shielded 8-Position modular plugs manufactured for 24 AWG solid conductor SF/UTP cabling. Modular plugs manufactured for stranded conductors and/or unshielded cabling is not permitted.
 - a) Digital AV cabling shall be plenum rated SF/UTP shielded foil twisted pair design providing superior noise immunity and high performance transmission of high-resolution digital signals.

- 1) Manufacturer Extron, Part No. 22-235-03
- b) RJ-45 shielded plugs shall provide integrated conductor alignment guides to separates the individual conductor pairs for quick and easy termination.

- 1) Manufacturer Extron, Part No. 101-005-02 (Qty. of 10)

B. Page Interrupt Cabling & Connectivity

- 1. Intercom/Paging system shall provide page interrupt to the AV switcher when a page occurs in the classroom.
 - a) Cabling shall be 22 AWG, 2-conductor stranded wire, plenum rated from the AV switcher “Page Sensor” to the IP intercom clock general purpose I/O port. Provide two position .100-inch Molex housing with female crimp terminals at the intercom clocks GP I/O and 3.5 mm captive screw connector at the AV switcher.
 - 1) Manufacturer Belden or approved equal:
 - a) 22 AWG, 2-conductor, Part No. 82442
 - 2) Manufacturer Molex or approved equal:
 - a) Two position housing, Part No. 50-57-9002
 - b) Gold female crimp terminal, Part No. 16-02-1125
 - 3) Manufacturer Extron:
 - a) 3.5 mm captive screw 10-pack, Part No. 100-456-01

C. IR Emitter and Shield

- 1. IR emitter shall control equipment remotely. Kit shall be installed directly on the IR control window of the controlled equipment. IR emitter shall consists of a tiny infrared light-emitting diode housed in a miniature, injection molded shell with a 10-foot (3 m) wire lead.
 - a) Manufacturer Extron, Part No. 70-283-01

D. Category 6A Patch Cords

- 1. Patch cords shall be UL[®] listed, constructed from Category 6A 4-pair 24 AWG and meet FCC Part 65 plug and termination.
 - a) Provide non-plenum patch cable material where located in a concealed j-box or non-plenum ceiling spaces.
 - b) Provide low smoke zero halogen patch cable material where located above plenum rated ceiling spaces.

2. Cat 6A patch cord shall be provided at each video projector and AV controller for the connection to the network cabling at the device end.
 - a) Manufacturer Leviton (for Video Projector):
 - 1) Non-plenum, Part No. 6D460-15W
 - 2) Low-smoke zero halogen, Part No. 6H460-15W
 - b) Manufacturer Leviton (for AV Controller):
 - 1) Non-plenum, Part No. 6D460-9W
 - 2) Low-smoke zero halogen, Part No. 6H460-9W

2.05 OPEN CABLING & DEVICE MOUNTING SUPPORTS

- A. Accessories and mounting hardware shall be provided for securing supports to structure for a complete and working installation of open cabling supports. Supports shall comply with TIA requirements for structured cabling systems and pathway supports. Follow manufacturer's recommendations for quantity of cables supported.
- B. Hook & Loop Fasteners:
 1. Hook and loop fastener rolls shall be 0.5-inch in width. Shear strength for plenum hook and loop fasteners shall be 29 PSI. Hook and loop fasteners installed in plenum air spaces shall be UL Listed (plenum) and be in the color maroon.
 - a) Manufacturer Leviton, plenum, Part No. 43115-75P or equal
 2. Hook and loop fastener rolls shall be 0.5-inch in width. Shear strength for non-plenum hook and loop fasteners shall be 23 PSI.
 - a) Manufacturer Leviton, non-plenum, Part No. 43115-75 or equal
- C. J-Hooks:
 1. J-hooks shall have a Galvanized finish with rounded edges for smoother cable pull and greater corrosion resistance.
 - a) Manufacturer Erico Caddy, 1-inch Dia., Part No. CAT16HP

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide all labor, tools, supplies, software, hardware, materials, and equipment required for the design, installation, configuration/ programming and testing of a complete and operational system.
- B. System shall be installed in accordance with details on the Contract Documents and manufacturer's installation instructions.
- C. Cabling shall be installed in conduit, cable tray or using open cabling methods when installed above accessible ceilings.
- D. Where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway.
- E. Cabling shall not be enclosed in conduit or raceways containing AC power.
- F. Devices shall be securely mounted. Provide necessary backing in walls or ceilings.
- G. Properly ground the system per NEC requirements to the building safety grounding system to prevent electrostatic charges and other transient electrical surges from damaging the control panel.

3.02 OPEN CABLING SUPPORT INSTALLATION

- A. All cable that is installed above suspended ceiling areas shall be run in j-hooks above the ceiling grid and will not be allowed to lay on the grid.
 - 1. Provide all hanger supports and cable supports for cabling specified in this section, unless routed within conduit. All support structures shall adhere to the requirements in the National Electrical Code.
 - 2. Cabling supports shall be spaced no further than 4-feet-0-inches apart.
 - 3. Cabling bundles shall not sag, a maximum of two-inches from the bottom of the cable support.
 - 4. Cabling supports shall be installed on their own support system. The use of ceiling grid supports shall be prohibited.
- B. Cabling connecting to AV devices in the classroom shall not be coiled inside of the equipment housing. Provide minimal amount of slack for servicing of equipment and to allow connections to be seated properly. Cabling shall be neatly coiled in a figure 8 pattern above the ceiling segregated by cable type.

- C. Twisted pair cabling utilizing open cabling methods shall maintain a minimum separation of three inches from fire alarm, intercom paging, security and CATV broadband cabling. Cabling supports shall maintain increased separation requirements when attaching to the same hanger rod to ensure cabling sag maintains the minimum three-inch separation.
- D. Speaker cabling shall be run in a separate conduit and/or open cabling supports.
- E. Maintain the following distances between cabling and other building systems:
 - 1. One foot from fluorescent lights.
 - 2. Six feet from motors and transformers.
 - 3. Three feet from water piping or other mechanical equipment.
 - 4. One foot from electrical conduits or other electrical equipment.
- F. Do not support cables from ductwork, sprinkler piping, water piping, waste piping, conduit or other system supports. Cabling shall never come in physical contact with these mechanical, fire protection and electrical systems and raceways.

3.03 LABELING

- A. Provide computer generated wrap around label on both ends of the cabling jacket no more than 4-inches from each termination point.
 - 1. Labels shall identify connection point (i.e. HDMI-1, HDMI-2, Audio In or Out, ALS, etc.).
- B. Faceplates shall be identified with computer generated labels for each output and input.
 - 1. Labels shall identify connection point (i.e. HDMI-1, HDMI-2, Audio In, ALS, etc.).
- C. Audio visual controller source buttons shall be labeled to correspond with the labels on the device faceplates.

3.04 CABLE TESTING

- A. Continuity tests shall be performed on all twisted pair cabling.
- B. Testing procedures shall include the following parameters for each pair of each cable installed:
 - 1. Wire map

- a) Continuity to the remote end.
 - b) Shorts between any two or more conductors
 - c) Reversed pairs
 - d) Split pairs
 - e) Transposed pairs
 - f) Shield continuity (SF/UTP cabling only)
 - g) Any other miswiring
- C. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures and referenced to the appropriate cable identification number and circuit or pair number.

3.05 PROGRAMMING & TESTING

A. Initial Programming

1. Verify all system components are updated to the latest firmware version.
2. Verify the latest software is being used to configure all devices.
3. Update EDID settings to match the connected displays EDID.
4. GlobalViewer folder tree shall be configured as District Name (folder 1), School name (folder 2), Room Number (folder 3)
 - a) GlobalViewer Enterprise ID shall be set as the school name, even if it is not being utilized at this time.

B. System Programming

1. System shall be programmed to automatically shut down video projectors and/or displays at a specific time each day. Confirm requirements with Owner.
2. Power Off button shall include a 2-second delay in order to turn off the video projector and/or display.
3. Source select buttons shall turn amber in color when the source is selected.
4. "Upload Enhanced Web Pages" and "Upload PoleVault Web User Interface" shall be checked.

C. AV Controller

1. Provide connections to equipment control ports, i.e., RS-232, IR, Digital I/O, contacts as required and as indicated in the Contract Documents.

2. The controller shall be connected to the school LAN utilizing Cat 6A horizontal cable and patch cord.

D. Video Projector

1. Video projector shall be installed per the manufacturer instructions. Coordinate and/or confirm mounting heights of video projector prior to installation.
2. Provide installation of video projector and all connections to the AV switcher / amplifier whether provided under this specification or not.
3. Coordinate with the Owner for the teacher's computers operating system. Verify version of software and firmware on each video projector and update to the current version as required. Confirm video projector's software and firmware is compatible with the computers operating system in place.
4. Align video projector image on projection surface. Image shall be centered on the intended whiteboard space and shall not project onto marker tray, side and/or top bezel of whiteboard.
5. Key stoning the image and/or manipulating the image is not acceptable.

E. Audio Settings

1. Audio settings shall be adjusted so that the audio level output is consistent in each of the classrooms/ conference rooms.
2. The output of the amplification system shall be connected to a minimum of two flush / ceiling mounted speakers as indicated on the contract drawings, unless noted otherwise.
3. The line out audio of the amplification system shall be connected to the audio out on the HDMI plate.
4. Audio output setting shall be adjusted to maintain continuous system operation, and not allow the AV switcher to go into "Auto Shut Off/ Power Save" mode. Auto shut off/Power save mode shall be disabled.
5. The Aux Audio input shall not duck other audio sources; uncheck "Enable Ducking" in the Aux Audio Configuration Tab on the switchers' configuration page to allow audio mixing.

F. Audio Visual Devices

1. Connect to each device plate and verify that audio and video signals are being broadcasted correctly.

G. Page Interrupt

2. Incoming intercom page to the space shall duck the audio-visual systems audio levels and automatically reestablish audio levels after intercom page is complete.
 3. Coordinate with the intercom clock integrator to ensure the following steps have been completed prior to testing:
 - a) Adjust the paging sensor sensitivity on the front panel of the switcher to a mid-range setting. With audio active on the AV system, send audio to the IP intercom clock device and verify the AV switchers audio is muted during the broadcast. Adjust the sensitivity settings as required.
- H. Prior to requesting the acceptance test, Contractor shall correct any deficiencies discovered as the result of the programming and testing.

3.06 FINAL ACCEPTANCE

- A. Contractor shall submit a request for the Acceptance test in writing to the Owner no less than twenty-one days prior to the requested test date. The request for acceptance test shall constitute a certification from the Contractor that all Work is complete and in compliance with the Contract Documents; all systems have been tested; and that all corrections have been made.
- B. Acceptance testing shall be completed using the Owner's installed computing/ audio devices that are to be used in that space in order to denote actual conditions.
- C. Acceptance test shall be scheduled during a period when the building is unoccupied, and a complete system test can be accomplished. Contractor shall provide the services of no fewer than two (2) technicians to perform the acceptance test. Technicians performing the acceptance test shall have been involved in the installation of this project and shall be thoroughly familiar with all aspects of the Work. Technicians shall be equipped with portable two-way radios that will be used during the test.
- D. Contractor shall provide all ladders, tools, test equipment, and other facilities needed to accomplish the Acceptance test.
- E. During acceptance test, Contractor shall demonstrate all equipment and system features to the Owner. Contractor shall fully cooperate with the Owner and provide assistance with the inspection and test. Contractor shall remove and reinstall covers, open and restore wiring connections, operate equipment, and perform other reasonable work as requested by the Owner.

- F. Any portions of the Work found to be deficient or not in compliance with the Contract Documents will be rejected. Owner will record any such deficiencies observed during the Acceptance test. A copy of said list will be provided to Contractor. Contractor shall promptly correct all deficiencies.

3.07 WARRANTY AND SERVICE

- A. Contractor shall provide parts and labor guarantee on all Work. Unless otherwise specified herein, Contractor's guarantee shall be for a period of one (1) year from Date of Acceptance, except where any specific guarantees from a supplier or equipment manufacturer extends for a longer time.
- B. Contractor's guarantee shall cover all costs associated with troubleshooting, repair, and replacement of defective Work, including costs of labor, transportation, lodging, materials, and equipment.

3.08 TRAINING

- A. Owner shall receive 4 hours of instruction in four (4) 1-hour segments covering all aspects of the Classroom Audio Visual System.

END OF SECTION 27 4100

SECTION 27 5126
ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. This Section Includes:

1. Fixed equipment Assistive Listening System.
2. Portable equipment Assistive Listening System.

1.02 Related Sections:

- A. Electrical Requirements – Division 26 specifications
- B. ALS Requirements and Summary

1. Assistive-Listening systems shall be provided in accordance with CBC Section 11B-219 and shall comply with CBC Section 11B-706.
2. Per CBC Section 11B-219.3, the minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with CBC Section 11B-706.3
3. If the system provided is limited to specific areas or seats, then such areas or seats shall be within a 50 foot viewing distance of, and have a complete view of, the stage or playing area. CBC Section 11B-219.4
4. Per April 2020 DSA Code Appeal Interpretation, school facilities may use the following alternate provision; For each school, provide 2 portable assistive listening systems, each with a transmitter and a minimum of 2 receivers for use in classrooms with audio amplification. The assistive listening receivers and transmitter shall be stored in the school site administration office until requested.

- a) In addition, provide an assistive listening system for assembly areas such as multi-purpose rooms, cafeterias, lecture halls or other assembly areas. If the room has no fixed seating, calculate the number of seats using 7 SF per occupant. Provide 4% of assistive listening receivers for total number of seats in each assembly area, but no less than 2. The assistive listening receivers shall be stored in or near the assembly area.

1.03 REFERENCES

- A. Drawings and general provisions of the Contract, including General- and Supplementary-Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.
- B. In addition, the products covered in this Section, except as noted, shall be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:
 - 1. American National Standards Institute
 - 2. ASTM American Society for Testing and Materials
 - 3. IEEE Institute of Electrical and Electronics Engineers
 - 4. CEC California Electrical Code
 - 5. NECA National Electrical Contractors Association "Standard of Installation"
 - 6. National Electrical Manufacturers Association
 - 7. NFPA National Fire Protection Association
 - 8. Underwriters Laboratories, Inc.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections.
- B. Shop Drawings: Include 1/8" scale floor plans indicating layouts, showing cabinet dimensions, conduit entrances, all device/equipment locations (including racks, chargers, antennas, etc.), single line/wiring diagrams, device ratings and cable termination provisions.
- C. Product Data: Submit for each type of product specified.

- D. Operating, Maintenance, and Instructional Data: Manufacturers' written operating, maintenance, and installation instructions, including directions for storage and protection, handling, examination, and preparation.
- E. In addition, include copies of this data in Operating and Maintenance Manuals submitted, see Division 26.
- F. Samples: Provide samples upon specific request.
- G. Certificates:
 - 1. Copy of the contractor's current C7 California State Contractors license.
 - 2. Copy of the manufacturer's letter stating the installing contractor is trained and certified to both sell and install the proposed equipment.
 - 3. Labels of UL listing, fixed to each item of material.
 - a) Label of UL listing for service entrance use, where applicable, affixed to material.

1.05 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.
- B. Electrical Component Standard: Components and installation shall comply with California Electrical Code (CEC).
- C. NEMA and UL Compliance: Products shall comply with applicable requirements of NEMA and UL standards. Provide products and components listed and labeled by UL.
- D. NECA Installation Standards: Perform work in accordance with NECA "Standard of Installation."
- E. Source Quality Control: Quality control testing shall meet applicable Underwriters' Laboratories Inc. Standards.

1.06 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store, protect, and handle products to site in accordance with the General- and Supplementary Conditions, Division 1 Specification Sections.
- B. Store and protect product in accordance with manufacturer's instructions, and in a manner to prevent damage from the elements, personnel, equipment, and moisture.

1.07 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Verify that field measurements are as shown prior to commencing the work.

1.08 EXTRA MATERIALS

- A. Furnish 5% quantity of rechargeable batteries for portable devices, minimum 2 sets.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. All equipment listed herein will be by Listen Technologies, or approved equal by Williams sound or Phonic ear.
- B. All basic electronic equipment specified herein shall be produced by a single manufacturer who shall have produced similar apparatus for a minimum of three years or more, and be able to refer to similar installations of project type experience.

2.02 PRODUCTS

- A. The ALS system shall provide the following minimum functions and capabilities.
- B. The FM wireless ALS (stationary or portable system per location) is for use by the hearing-impaired.
- C. The ALS system shall be capable of broadcasting on 57 channels, be frequency agile and have 80db SNR or greater, end-to-end.
- D. Receivers shall be frequency agile, with the frequency set with a “seek” button, incorporating an LED display that indicates battery status, RF signal strength and channel. Receivers shall incorporate a stereo headset jack that allows the use to plug in either mono or stereo headset.
- E. Portable transmitters and receivers shall incorporate automatic battery charging circuitry for the recharging of NiMH batteries.
- F. The following shall be used as a guide, and are to be included, but not limited to, in the system(s) to be supplied:
 - 1. Listen Technologies LT-800 Stationary Transmitter (Antenna as required).
 - 2. Listen Technologies LT-700 Portable FM Transmitter

3. Listen Technologies LR-400 Portable Receiver (With LA-164 ear Speaker)
4. Listen Technologies LR-100 Stationary Receiver / Power Amplifier (Receiver)
5. Listen Technologies LA-600 Wireless Remote Speaker / Receiver
6. Listen Technologies LA-122 Universal Antenna Kit.
7. Listen Technologies LA-261 Lapel Microphones
8. Listen Technologies LA-262 Head-worn microphones (for use with LT-700)
9. Listen Technologies LA-263 Line Input Cable
10. Listen Technologies LA-326 Rack mount kit with plexi-glass security cover.
11. Listen Technologies LA-321 / 311 (8) or (16) Unit Charging Carrying Case with removable lid.
12. Listen Technologies LA362-NiMH rechargeable batteries, (2) required per portable device.
13. Listen Technologies LA-304 ADA Access / compliance signage kit(s)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Furnish all conduit, boxes, connectors, plugs, wiring, cabling and labor for a complete and operable system.
- B. Install antennas where indicated on plans, or as directed by manufacturer to provide complete coverage in all areas required for assistive listening system.
- C. Adjust all controls and antenna for optimal system operation.
- D. Provide supports to the building structure, independent of raceways.
- E. Provide identification for system components and wiring per 260553.

3.02 FIELD QUALITY CONTROL & TESTING

- A. Perform manufacturer's recommended field test prior to operation. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the frequency response of all transmitters/receivers are as stated in the factory data sheets, and provide copies of test results to Owner.
- B. Provide copies of test results to Owner.

3.03 WARRANTY

- A. Prior to Owner acceptance, the contractor shall provide to the Owner, a manufacturer's product and performance warranty. This will require a submittal of the required pre-bid certification registration forms as well as required project close out information.
- B. Warranty shall commence from the date of written final acceptance by the Owner.
- C. A typewritten notice shall be posted at the equipment rack(s) that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside door.

END OF SECTION

SECTION 28 1000
ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES

1. Verkada cloud-based access control solution including cloud-based management platform using Verkada Command and the Verkada Pass App, AC41 4-Door Controller, AX11 IO Controller with Video Analytics Event Bridge, integration with Allegion Schlage AD Series (AD300, AD400, PIM400) and the Engage series (NDEB, LE, LEB) wireless locks, AD31 Multi-Format Card Reader, AD32 Multi-Format Card Reader, Verkada Badge Printing Software, ACC-Prox-1 Proximity Cards, and accessories.

B. RELATED SECTIONS

1. 27 1000 – Telecommunications System
2. 28 2000 – Video Surveillance System
3. 28 3100 – Intrusion Detection System

1.02 REFERENCES

A. Published specifications, standards, tests, Codes, or recommended standards of trade, industry, or governmental organizations apply to work in these Sections, including:

1. ADA – Americans with Disabilities Act
2. ANSI – American National Standards Institute
3. ASCII – American Standard Code for Information Interchange
4. ASTM – American Society for Testing and Materials
5. IBC – International Building Code
6. IEEE – Institute of Electrical and Electronics Engineers
7. ISO/IEC – International Organization for Standardization / International Electrotechnical Commission

8. NEC – National Electrical Code
9. NEMA – National Electrical Manufacturers’ Association
10. NFPA – National Fire Protection Association
11. TIA/EIA – Telecommunications Industry Association / Electronic Industries Alliance
12. UL – Underwriters Laboratories, Inc.

1.03 DEFINITIONS

A. Abbreviations:

1. ACS – Access Control System
2. API – Application Programming Interface
3. DHCP – Dynamic Host Configuration Protocol
4. DPDT – Double pole, double throw
5. IP – Internet Protocol
6. LAN – Local Area Network
7. NFC – Near Field Communications
8. NVR – Network Video Recorder
9. ODBC – Open Database Connectivity
10. RAM – Random Access Memory
11. SPDT – Single pole, double throw
12. SSL – Secure Sockets Layer
13. SSO – Single sign-on
14. TCP – Transport Control Protocol
15. UPS – Uninterruptible Power Supply
16. VMS – Video Management System

B. Definitions:

1. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format.
2. Proximity Readers and Credentials: Readers and cards employing 125 KHz communication to validate when the card is presented within the proximity of the card reader.
3. Smart Card Readers and Contactless credentials: Readers and cards employing 13.56 MHz encrypted communication to validate when the card is presented within the proximity of the card reader.
4. Credential: Data assigned to an entity and used to identify that entity.
5. Trigger: Enables an action or a series of actions that are sent across any or all controllers, readers, contacts, or relays throughout the system. Triggers can be used to send commands to change the state of a door, multiple doors, contact states, relay states, shunt points, lockdowns or to activate predetermined overrides.
6. Pass-Through: The ability assigned to a person's credential that allows them to access a door even if in lockdown state.
7. Lockdown: An input or a credential that allows the system to be placed into a lockdown state.
8. Wiegand: Patented magnetic principle that originally used specially treated wires embedded in the credential card. Today Wiegand has become the communication standard for most reader heads.

1.04 SYSTEM DESCRIPTION

- A. Verkada Access Control combines enterprise-grade access control with a powerful, cloud-based management platform for a solution that's always simple, secure, and ready for scale. Starting with Verkada's Access Controller, users are able to bring plug-and-play simplicity to managing doors and access across their organization. Access controllers work with your building's existing door hardware and readers. Once doors are connected, they are ready to be managed via Verkada Command on the web or mobile devices. The Verkada Command platform allows you to easily manage building access, schedules, and users. Integration to active directory platforms ensure that employees are automatically configured, onboarded and offboarded. Through Verkada Command, access control and cameras are connected seamlessly to deliver real-time video analytics on access events. Using Verkada's industry-leading edge-based video processing, users are able to not only see what is happening at their points of entry, but also proactively take action for meaningful events.
- B. Cloud-Based Access Control

1. Simple to Install
 - a) No on-premise servers, thick or thin clients
 - b) Doors come online and configure in minutes
 - c) No added software or complexities like port forwarding
2. Security / Encryption Standards
3. Easy to Use
 - a) Centralized management for seamless access anywhere
 - b) No training required to access doors, peripherals, footage, and features
 - c) Access doors from any device
 - d) Seamlessly add and integrate video security
4. Advantages of Cloud-Managed Solution
 - a) Secure remote access on any device anywhere
 - b) SAML-based integration with single-sign on (SSO) solutions
 - c) Continuous updates with new features
 - d) Instantly share live footage via SMS and email
5. Ready For Scale
 - a) Cloud-based platform has no device/user limits
 - b) Scale to thousands of doors across all locations
 - c) No need to create virtual networks to sync access across sites
6. No Hidden Costs
 - a) Hardware includes an industry-leading 10-year warranty
 - b) New features and enhancements are added at no additional costs
7. Firmware
 - a) Automatic firmware updates keep systems secure
 - b) Firmware version can be verified and upgraded in the Command dashboard at command.verkada.com

C. Verkada Command: Access Control Cloud-Based Management Software

1. User Management and Permissions
 - a) Import Users via CSV or add users manually
 - b) Manage Users and Groups automatically with 3rd party IDPs via SCIM including (but not limited to) Okta, Azure AD, CyberArk
 - c) Control door access via user groups and Access Levels
 - d) Assign multi-format Credentials including cards, pins, and mobile Bluetooth access
 - e) Support bulk upload of User Photos for use in system display and card management
2. Door and Peripheral Management
 - a) Instantly see events including live and historical footage
 - b) Filter by events such as unlocks, door opens, and access granted or denied
 - c) Create custom lock / access control / unlock / card + pin code schedules
 - d) Programmable inputs and outputs
 - e) Support for elevators security via configurable outputs
3. Video Integration
 - a) Associate existing Verkada cameras with doors for increased visibility
 - b) Add multiple cameras to see events from multiple angles
 - c) Quickly export video evidence for investigations
 - d) View video events associated with a door
 - e) View video events associated with any individual easily
4. Site Management
 - a) Manage admins on a site-by-site basis. Allow certain Users the ability manage one site and not another.
 - b) Support for different Admin roles within the management platform
5. Alerting and Events
 - a) Configure real-time alerts via SMS or Email
 - b) Configurable alerts based on Door Held Open / Door Forced Open, Access Granted, Door Opens, Lockdowns, Offline, or Aux Trigger

- c) Alerts can be configured to only dispatch on a configurable schedule

6. Lockdown Capabilities

- a) Trigger a Lockdown via a wired button, wireless button, mobile app, or web
- b) System supports configurable User Groups to trigger Lockdowns
- c) System supports configurable User Groups for Access during Lockdowns
- d) System supports configurable User Groups for resolving / disabling Lockdowns

7. Reporting

- a) Standard reporting and extraction of data
- b) System support Roll Call / Mustering Reporting

D. Verkada Pass App Touchless Entry via BLE

- 1. Verkada Pass App is your digital credential for accessing buildings. The Verkada Pass App makes it easy to unlock doors using your phone by either tapping from inside the app or through Touchless Access made possible with Bluetooth.
- 2. The Verkada Pass App is available on iOS and Android.

1.05 SUBMITTALS

A. Provide the following submittals for review and approval:

- 1. Product Data and Shop Drawings
- 2. System Programming
- 3. Operation and Maintenance Manuals (O&M's)
- 4. "As-Built" Record Drawings

B. Submit Product Data and Shop Drawings submittals for review and approval prior to commencement of work:

- 1. Manufacturer's name, brand name, exact part number, options, accessories, and catalog cutsheet references for all equipment supplied including cabling. Include manufacturer's published installation instructions. Indicate UL listings for system components.

2. Complete wiring diagrams for all components, including cable types and quantities, routings, floor plans indicating device locations, conduit sizes, and point-to-point termination and riser diagrams.
 3. Device legend on the shop drawings that identifies the symbols used for all devices including mounting heights, back box requirements, part and model numbers, operating voltages (if applicable), wire and cabling requirements, label text, and panel termination points.
 4. Fully dimensioned shop drawings including floorplans, enlarged plans, elevations, and installation details of all security devices, equipment rooms and closets, consoles, controllers, racks, enclosures, and fabricated equipment, showing locations of all major components including mounting details. Indicate UL system and rating listings for penetration firestop systems through rated partitions and floors.
 5. Bill of Materials.
 6. Material Safety Data Sheets (MSDS) for fire stopping materials and sealants.
- C. Submit System Programming submittals for review and approval prior to commencement of work:
1. Proposed programming, including nomenclature conventions, device names and text descriptions, timings, camera call-up trigger alarms with associated cameras, and sequence of operations.
 2. Approved device names and text descriptions as programmed into the security systems shall be reflected on the “As-Built” Record Drawings as well as on device and cable labels.
- D. Submit Operation and Maintenance Manuals (O&M’s) submittals for review and approval prior to the completion of the project:
1. Updated product data and shop drawings submittals reflecting the final conditions.
 2. Warranty letter with start and end date.
 3. Warranty service and maintenance contact information: including names, address, phone number, and website address. Provide specific instructions or forms as required to initiate a trouble ticket or work order request.
 4. Letter indicating that all software and licensing is the sole property of the Owner.

5. Troubleshooting checklist information.
6. Replacement parts and consumables ordering information including the contact information for local sources.
7. Provide an updated System Programming submittal including:
 - a) Final listing of doors, locations, and normal status in CSV format.
 - b) System administration and management operating instructions.
 - c) Setting up Users, User Groups, Access Levels, Doors, Door Schedules, and Exceptions
 - d) Assigning Access Groups to all Users.
 - e) Monitoring system activity.
 - f) Running standard reports.
 - g) Setting up logins and permissions.
- E. Submit “As-Built” Record Drawings submittals for review and approval prior to the completion of the project:
 1. Maintain a complete set of “As-Built” Record Drawings at the project site updated with mark-ups of the actual installation conditions.
 2. Prior to the completion of the project transfer all installation conditions mark-ups to electronic drawings and submit to the Owner in CAD and PDF formats.

1.06 QUALITY ASSURANCE

- A. Equipment shall be tested and found to comply with the limits for a Class A or B digital device, pursuant to part 15 of the FCC rules.
- B. Security technology devices shall be mounted using compatible Verkada accessories.
- C. Security technology devices shall be of the latest technology. No discontinued models or products are acceptable.
- D. Installation technicians shall successfully complete the Verkada Certified Engineer (VCE) program prior to starting work. For more information, visit www.verkada.com/partners/trainings.
- E. Contractor qualifications:
 1. Minimum of two years of system design, engineering supervision, and installation experience in the access control industry.

2. Maintain a local office, with a service center staffed by trained technicians and must be adequately equipped to provide emergency phone service within 24 hours on a 24-hour, 365 days per year basis, whether or not the Owner purchases a maintenance contract with the Contractor.
3. Maintain an inventory of spare parts and other items critical to system operation, as necessary to meet the emergency service requirements.
4. Maintain an in-house engineering and project management capability consistent with the requirements of this project.
5. Provide a project manager who is actively engaged in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the submittals and project close-out documentation, training programs, system testing and report documentation, and the coordination of all subcontract labor. The Owner reserves the right to approve the Contractor's project manager.
6. Abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Ship equipment in original packaging to prevent damage. All handling shall be in accordance with manufacturer recommendations. Inspect all products and materials for any damage immediately upon delivery to the project site.
- B. Provide protective covering during construction.
- C. Replace equipment and products damaged during shipping, handling, distribution, storage, installation, or construction with new equipment and products.
- D. Equipment and products stored at the project site or at an off-site location shall be protected from dust, dirt, and foreign matter. Protect equipment and products from water, damage, dents, bumps, and scratches.

1.08 SCHEDULING

- A. Submit proposed construction schedule detailing the task milestones, durations, and sequences for the project for review and approval prior to commencement of work.
- B. When work is performed in a sensitive area or in an area occupied with ongoing business activities coordinate with the Owner and the affected department's representative to determine the best time to perform the work required.

1.09 WARRANTY

- A. Provide one-year parts and labor project warranty. Parts and labor shall be guaranteed against defects in materials and workmanship for one year from written notification of acceptance.
- B. All Verkada hardware purchases are backed by a 10-year limited warranty. For more information, visit verkada.com/support/terms-of-sale.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Manufacturer shall be Verkada Inc.
 - 1. Headquarters: 405 E 4th Ave. San Mateo, CA 94401
 - 2. Toll Free: (888) 829-0668
 - 3. General: team@verkada.com
 - 4. Sales: sales@verkada.com
 - 5. Website: www.verkada.com

2.02 LICENSING

- A. Provide all required licenses for the specified system components.
- B. Licensing is available in 1-year, 3-year, 5-year, and 10-year licenses.

2.03 DOOR CONTROLLER

- A. Door Controller shall be AC41 by Verkada Inc.
- B. Description
 - 1. Simple to Manage: Cloud-managed controller configures instantly and updates automatically.
 - 2. Reliable: Built-in storage ensures uninterrupted door functionality.
 - 3. Centralized Management: Managing doors, permissions, and users from anywhere with Verkada Command.
 - 4. Increased Visibility: Seamlessly integrates with existing Verkada cameras for unparalleled visibility.
- C. Key Features

1. Simplified wiring with an integrated cable management system and screwless push–spring terminals.
2. Removable cassettes are designed to make the installation and cabling process quick and easy. The AC41 comes equipped with four reader controller cassettes and a fifth cassette with two AUX (Normally Open) inputs and two AUX (Form C Relay) outputs.
3. Works with 3rd party readers and credentials.
4. Built–in testing interface for wired connections.
5. Integrated power supply powers most door strikes and handles without additional wiring. The AC41 comes equipped with a Form C relay that can be driven dry or wet. AC41 is rated to power 12V locks up to 700mA and 24V locks up to 350mA. Supports Fail Secure and Fail Safe lock configurations.
6. The AC41 supports up to two 12 Volt 4.5 Ah Sealed Lead Acid Rechargeable batteries for battery backup.

D. Technical Specifications

1. Power Consumption (at 10-14V):
 - a) No Readers: ~1000mA
 - b) 4 Wiegand Readers: ~2200mA
2. Power Supply:
 - a) 160W PSU (capped at 100W for safety)
3. Relays:
 - a) Dry (External Power Supply): 6 Relays – 4 Door, 2 AUX at 500mA / 30VDC
 - b) Wet (Powered by AC41): 12V – 700mA per relay max, 24V – 350mA per relay max
4. Inputs:
 - a) Nominal 5VDC: 1Kohm to each input (resistors built-in)
5. Contact Sensors:
 - a) 4 Contact Sensors: Nominal 5VDC, 1Kohm to each input (resistors built-in)

6. Dimensions:
 - a) With Mount: 415.6mm (L) x 319.6mm (W) x 111.74 (H)
 - b) Without Mount: 415.6mm (L) x 319.6mm (W) x 105.74 (H)
7. Weight:
 - a) 8.5kg
8. Operating Temperature:
 - a) 0°C ~ 50°C (32°F~ 122°F), 5–90% humidity
9. Compliance:
 - a) FCC, CE, UL 294, UL 62368-1/CSA C22.2, CAN/ULC-60839-11-1:2016, NDAA
10. Connectivity:
 - a) Ethernet: 100/1000Mbps RJ-45 cable connector for network connection USB 2.0
11. Included Accessories:
 - a) Setup guide, screw pack
12. Mounting Options:
 - a) Dry wall anchors (M8) and screws (M5)
13. Network Settings:
 - a) An Ethernet connection with DHCP must be used to connect the AC41 to the Local Area Network (LAN). You also need to configure firewall settings to communicate with the AC41 – TCP port 443, UDP port 123 (NTP time synchronization)

E. LED Indicator

1. Solid Orange:
 - a) Controller is on and booting up
2. Flashing Orange:
 - a) Controller is updating firmware

3. Flashing Blue:
 - a) Controller is managing doors, but cannot reach the server
4. Solid Blue:
 - a) Controller is managing doors and connected to the server
5. Flashing Pink:
 - a) Identify

F. Testing Interface

1. Door:
 - a) Pressing the “Door” button will cycle which door is selected for testing.
2. Trigger Lock:
 - a) Trigger the lock relay on the selected door. When triggered, the LED will be off.
3. Emulate DPI:
 - a) Emulate the door position indicator. When a door is closed, the LED is on.
4. Emulate REX:
 - a) Emulate the request-to-exit. When the REX is triggered, the LED is on.

- G. Ensure power is disconnected from the AC41 before servicing the product and before connecting or disconnecting peripherals.

2.04 IO CONTROLLER

- A. IO Controller shall be AX11 by Verkada Inc.

B. Description

1. Provides 16 AUX inputs and outputs.
2. Versatility: Strengthen access control by incorporating additional sensors and hardware to trigger and respond to building events.

3. Event Bridge: Bring door events with video analytics into Command while continuing to use your existing access control or alarm system.
4. Access Control Elevators: Manage access to different floors of the building with a Verkada or Wiegand reader.
5. Seamless Integration: Pair with cameras to improve video tagging for door-based events—including door held/forced open—and leverage Alarms for intrusion detection.

C. Key Features

1. Removable connectors and cable management loops simplify wiring.
2. Status LEDs for inputs, outputs, and readers accelerate debugging.
3. Supports both Verkada (over RS-485) and 3rd party card readers (over Wiegand).
4. Detachable wall mounting plate streamlines installation.
5. The AX11 supports up to two 12 Volt 4.5 Ah Sealed Lead Acid Rechargeable batteries for battery backup.

D. Event Bridge

1. Event Bridge with the AX11 makes your Verkada cameras even more powerful. Add video analytics to your doors, even if they are not secured by Verkada. Access events will stream into Command to give you better visibility of your entrances and exits. The best part is that you can continue using your existing access control or alarm system since functionality of your door panels is unaffected.
2. Instant Video Analytics for Any Door: Pair a Verkada camera to get video context on any door event and integrate computer vision functionality like Person of Interest detection.
3. Live and Historical Access Events: Enable the Access tab to see when the door is opened and held open as well as door activity over time. View all your cameras and doors from Verkada's centralized Command platform.
4. Real-time Alerts and Reports: Configure granular SMS or email notifications for more proactive incident response. Export reports to investigate or audit historical events.
5. Best of Both Worlds: Continue using your existing access control or alarms system to avoid disruptions to your business. AX11 Event Bridge does not require a full system migration, so installs take hours, not days.

6. Alarms Integration with Professional Monitoring: Door events can be triggers for Verkada Alarms. While your site is armed, agents will review video footage of these events from nearby cameras in real time.

E. Technical Specifications

1. Power Consumption:
 - a) 60W Max
2. Power Supply:
 - a) 110-240VAC, 50-60Hz
3. Inputs:
 - a) 16 Dry Inputs, Nominal 5VDC
4. Relay Outputs:
 - a) 16 Dry Relays, 1A/24VDC Contacts
5. Aux Power:
 - a) 16 inputs and 16 outputs, 2 External Outputs, 1A/12V Power Each, 2A Combined Max
6. Dimensions:
 - a) With Mount: 415.6mm (L) x 319.6mm (W) x 111.74 (H)
 - b) Without Mount: 415.6mm (L) x 319.6mm (W) x 105.74 (H)
7. Weight:
 - a) 8.3kg
8. Operating Temperature:
 - a) 0°C ~ 50°C, 5–90% humidity
9. Compliance:
 - a) FCC, CE, UL 294, UL 62368-1/CSA C22.2, CAN/ULC-60839-11-1:2016, NDAA
10. Connectivity:

- a) Ethernet: 100/1000Mbps RJ-45 cable connector for network connection USB 2.0

11. Included Accessories:

- a) Setup guide, screw pack

12. Mounting Options:

- a) Dry wall anchors (M8) and screws (M5)

13. Network Settings:

- a) An Ethernet connection with DHCP must be used to connect the AX11 to the Local Area Network (LAN). You also need to configure firewall settings to communicate with the AX11 – TCP port 443, UDP port 123 (NTP time synchronization)

F. LED Indicator

1. Solid Orange:

- a) Controller is on and booting up

2. Flashing Orange:

- a) Controller is updating firmware

3. Flashing Blue:

- a) Controller is managing inputs and outputs but cannot reach the server

4. Solid Blue:

- a) Controller is managing inputs and outputs and is connected to the server

G. AX11 AC Power LED Indicator

1. Solid Green:

- a) AC power supplied to controller

H. AX11 Recommended Testing

- 1. To ensure ongoing functionality of AX11, it is recommended to check the following interfaces every 6 months:

- a) Short each input to its adjacent COM port and verify LED illuminates
 - b) Use multimeter to confirm expected impedance across relay outputs: Short across NC and COM and Open across NO and COM
 - c) Use multimeter to verify aux voltage is supplied at 12V outputs
- I. Ensure power is disconnected from the AX11 before servicing the product and before connecting or disconnecting peripherals. Ensure power is disconnected from the AX11 before plugging in or unplugging any of the terminal blocks. Failure to do so may damage the AX11.

2.05 INTEGRATED CARD READER DOOR LOCKS

- A. Electromagnetic Locks: Verkada Access Control integrates with the Allegion Schlage AD Series (AD300, AD400, PIM400) and the Engage series (NDEB, LE, LEB) wireless locks.
 - 1. Connect doors secured by locks to the same Access Control Unit.
 - 2. Easily set up and configure doors from Command's intuitive web interface.
 - 3. Manage all doors and ACUs in Schlage mode from a centralized, cloud-based platform.
- B. Allegion Schlage AD Series (AD300, AD400, PIM400)
 - 1. Refer to Allegion Schlage documentation for hardware installation.
 - 2. The Schlage AD series of locks come in two major variants, the AD400 wireless lockset and the AD300 wired lockset. The AD400 wireless lock connects to the Verkada AC41 through a wireless bridge called the PIM 400-485. The AD300 wired locks connect directly to the AC41. Both solutions communicate with the AC41 over RS485 via the aux RS485 port on the AC41 (the last cassette).
 - 3. The Schlage AD series of locks has the AD400 wireless lockset and the AD300 wired lock set. They act the same to the end user. The only difference is the AD300 wires directly to the AC41 via RS485 and the AD400 connects to the AC41 through a wireless bridge called the PIM-400-485. The configuration process in Command is identical with the exception of selecting Wireless (AD400) or Wired (AD300) in Command when adding the locks.
 - 4. The Schlage AD400 wireless lockset is configured using the Schlage Utility Software (SUS) which is a free Android app (there is no iOS app).

C. Allegion Schlage Engage series (NDEB, LE, LEB)

1. Refer to Allegion Schlage documentation for hardware installation.
2. This integration supports the NDEB, LE, and LEB series. The main distinction is that the LE and LEB locks are mortise locks.
3. NDE locks are not supported - they are outdated and use old SSL standards.
4. This integration is an offline integration. That means that all door events, user updates, schedule updates etc. will be published in command every 24 hours, unless forced to sync through the Allegion mobile app.
5. This means that the engage series integration does not support remote unlock or lockdowns.
6. Real time updates are available for tamper events and door forced open events.

2.06 MULTI-FORMAT CARD READER

A. Multi-format card reader shall be AD31 by Verkada Inc.

B. Description

1. Access doors using low and high frequency cards, as well as a mobile device with the Verkada Pass App.
2. Two-way communication with an integrated LED to display door status for entry and events.
3. Protected against the harshest environments with an IP66 and IK08 rating.
4. Access and manage the AD31 from Verkada's cloud-based Command platform.

C. Technical Specifications

1. Dimensions:
 - a) 120 x 76 x 21.5mm (4.7 x 3 x .85 in)
2. Low Frequency:
 - a) HID Prox II 26-Bit (H10301), 37-Bit Wiegand HID H10304, 37-Bit Wiegand HID H10302, HID 35-Bit Corporate 1000
3. High Frequency:

- a) MiFare / DESFire (CSN), NFC
- 4. Ratings:
 - a) IP66, IK08
- 5. Compliance:
 - a) FCC, CE, UL 294, UL 62368–1/CSA C22.2 No. 62368–1, CAN/ULC–60839–11–1:2016
- 6. Operating Temperature:
 - a) –30° to 65° C (-22° to 149° F)
- 7. Controller Compatibility:
 - a) Requires Verkada AC41 Access Control Unit
- 8. Mounting:
 - a) Standard single gang
- 9. Power Consumption:
 - a) 200mA at 12V

D. LED Indicator

- 1. White:
 - a) Reader is active and ready for secure badge entrance.
- 2. Green:
 - a) Reader has successfully processed a user scan.
- 3. Red:
 - a) Reader has identified a negative read. Re-scan or investigate bad scan.

E. Wiring (RS-485)

- 1. Wire Color / Abbreviation / Name
 - a) Black / - / Ground
 - b) Blue / B / RS485–B

- c) Purple / A / RS485–A
- d) Red / + / +12V IN

F. Wiring (Wiegand)

- 1. Wire Color / Abbreviation / Name
 - a) Orange / V0 / Wiegand Voltage
 - b) Gray / GND / Wiegand RTN
 - c) Green / WD0 / Wiegand Data 0
 - d) White / WD1 / Wiegand Data 1
 - e) Brown / LED / Wiegand LED
 - f) Yellow / BUZZER / Wiegand Buzzer

2.07 MULTI-FORMAT CARD READER

A. Multi-format card reader shall be AD32 by Verkada Inc.

B. Description

- 1. Access doors using low and high frequency cards, as well as a mobile device with the Verkada Pass App.
- 2. Two–way communication with an integrated LED to display door status for entry and events.
- 3. Protected against the harshest environments with an IP65 and IK08 rating.
- 4. Access and manage the AD32 from Verkada’s cloud–based Command platform.

C. Technical Specifications

- 1. Mullion Dimensions:
 - a) 95 x 45 x 21mm (3.7 x 2.9 x .82in)
- 2. Single Gang Dimensions:
 - a) 120 x 80 x 21mm (4.7 x 3.1 x .82in)
- 3. Low Frequency:
 - a) HID Prox II 26-Bit (H10301), 37–Bit Wiegand HID H10304, 37–Bit Wiegand HID H10302, HID 35–Bit Corporate 1000

4. High Frequency:
 - a) MiFare / DESFire (CSN), NFC
5. Ratings:
 - a) IP65, IK08
6. Compliance:
 - a) FCC, CE, UL 294, UL 62368–1/CSA C22.2, CAN/ULC–60839–11–1:2016, NDAA, TELECOM
7. Operating Temperature:
 - a) –40° to 65°C (–40° to 149°F)
8. Controller Compatibility:
 - a) Requires Verkada AC41 Access Control Unit
9. Mounting:
 - a) Unit ships with both standard Single Gang mounting plate and Mullion mounting plate
10. Power Consumption:
 - a) 12V, 300mA max

D. LED Indicator

1. Static status LED:
 - a) Powered on and connected to the ACU.
2. Cascading status LED:
 - a) Powered on but cannot connect to the ACU.
3. Green feedback LED:
 - a) Has successfully processed a user scan and granted access.
4. Red feedback LED:
 - a) Has successfully processed a user scan and denied access.

E. Wiring (RS-485)

1. Wire Color / Abbreviation / Name

- a) Black / GND / Ground
- b) White / A / RS485–A
- c) Green / B / RS485–B
- d) Red / +12V / +12V IN

2.08 BADGE PRINTING SOFTWARE

A. Badge printing software shall be Verkada Badge Printing Software by Verkada Inc.

B. Description

- 1. Verkada’s badge printing software is a modern, simplified way to design and print employee and student badges. With badge printing, Verkada Access Control customers can now easily design, print and administer credentials across both physical badges and the Verkada Pass App, directly through Verkada Command.
- 2. For more information refer to the Verkada Badge Design and Printing Set Up Guide.

C. Key Features

- 1. Simplified Badge Printing: By embedding badge printing software within Verkada’s user interface, customers can now manage the entire workflow with Verkada Command, saving time and software costs. Customers can design and print badges that leverage existing user profiles, active directory integrations, and of course, access control configurations — all from Verkada Command.
- 2. Printer Agnostic: Verkada’s badge printing solution is also printer agnostic and is compatible with most popular badge printers. Customers simply need to ensure that the badge printer driver is correctly installed on their computer and that their browser is able to recognize it. For customers without an existing badge printer, we have a recommended list of printers available on the Verkada Docs Page of our website.
- 3. Automated Profiles with SCIM: Verkada’s badge printing software extends the capabilities of Verkada Access Control and Automated user creation through Verkada’s SCIM integration and bulk user import functionality. Verkada Access Control customers can automatically synchronize their user profiles from single sign-on service providers like Okta and Azure Active Directory to more easily manage and manage user credentials.

4. Verkada Prox and NFC Cards: Verkada badge printing can print to any standard badge type supported on Verkada Access control — a full list is available on the Verkada website.

2.09 ACCESS CONTROL BADGES

- A. Access control badges shall be ACC-Prox-1 Proximity Cards by Verkada Inc.

- B. Key Features

1. Standard 26-Bit Prox Format
2. Works With Standard FSK Prox
3. T5577 Chip

- C. Technical Specifications

1. Name and Model Number:
 - a) ACC-PROX-1
2. Base Part Number – P/N:
 - a) 2A-68001-A
3. Descriptor:
 - a) Proximity Cards
4. Size:
 - a) 2.135” x 3.385” x 0.075” MAX. (5.4 x 8.6 x 0.19 cm)
5. Weight:
 - a) 0.24 oz (6.8 gm)

2.10 WIRED DOOR LOCK

- A. Provide door lock and install per District requirements.

PART 3 - EXECUTION

3.01 INSTALLERS

- A. Installation shall be performed by technicians that have successfully completed the Verkada Certified Engineer (VCE) program. For more information, visit www.verkada.com/partners/trainings.

3.02 EXAMINATION

- A. Installation surfaces shall be clean and free from dust, dirt, and obstructions.
- B. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- C. Examine rough-in for LAN and control cable conduit systems to server, PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

- A. Refer to the Verkada Quick Start Guide applicable to each product.
- B. Pre-Installation Conference: Prior to installation arrange conference between supplier, Owner, and related trades to review materials, procedures, and coordinating related work.
- C. Furnish or coordinate any inserts required for building into concrete, masonry, and other work, to support and attach work of this Section. Furnish or coordinate in ample time to comply with schedule of work into which inserts are built.
- D. Verify that power and outlets are in correct locations.
- E. Verify that building structure is properly prepared for mounting, attachment, and support of equipment.
- F. Prior to installation of systems components and devices, verify all required preparations have been properly performed and that substrates are acceptable for installation.
 - 1. Verify all rough-ins and field dimensions.
- G. Report in writing to the Owner's representative any prevailing conditions that will adversely affect satisfactory execution of work in this Section.
 - 1. Owner or their representative reserves the right to review proposed methods of construction and installation, reject proposed methods, and have the installation done in a satisfactory method at the Contractor's cost.

3.04 INSTALLATION

- A. Refer to the Verkada Quick Start Guide applicable to each product.
- B. For support, proceed to www.verkada.com/support.
- C. Sequencing: The work shall be performed in the following sequence, unless directed otherwise by Owner or their representative:
 - 1. Installation of cables, controllers, and power supplies.
 - 2. Installation of new field devices and new readers.
 - 3. Installation of front-end equipment.
 - 4. Commissioning of the new system components.
 - 5. End User training
- D. Install work in accordance with manufacturer's recommendations and instructions as well as final shop drawings. All controllers and power supplies should be installed so as to allow easy access for service in the future.
- E. Anchor components securely in place, plumb, level, and accurately aligned.
- F. For card readers located in equipment traffic areas, and that are exposed to damage due to collision or impact from forklifts, or manually moved carts, carriers, or other equipment used by the Owner, provide protective bollards, railings, coverings etc. to ensure that all card readers installed are properly protected from such damage.
- G. Provide fastenings, plates, and other incidental items required for complete and operational installation.
- H. Provide required electrical work in accordance with Code requirements.
 - 1. Security and protection:
 - 2. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured during periods when a qualified operator in the employ of Contractor is not present.
 - 3. Equipment protection: Provide protective covers, fenders, and barriers as necessary to maintain work of this Section in same condition as installed until time of substantial completion.
- I. Cable requirements:

1. Twisted, shielded, plenum-rated type cable shall be used.
2. All exposed cables shall be in rigid conduit, electrical metallic tubing (EMT) raceway, or wire mold as approved by the Owner.
3. All concealed cables routed in j-hook pathways shall be fastened to the structure at least every four feet.

3.05 LABELING

- A. Equipment and product labels shall be printed on self-adhesive labels. Hand written labels or writing directly on the equipment enclosures is not acceptable.
- B. Label equipment and products with the device address as programmed into the security systems and as reflected on the “As-Built” Record Drawings.
- C. Label networked equipment enclosures with the IP address.
- D. Cables shall be individually labeled at origin and termination.

3.06 PROGRAMMING

- A. Complete all Verkada Command configuration programming, including but not limited to:
 1. Personal/Staff information
 2. Access times for all personal/staff
 3. Definitions of openings for staff access
 4. Holiday definitions
 5. Special access privileges
 6. Lock down conditions
- B. Add all Verkada Access Controllers and Cameras to Command via serial number.
- C. Contract will coordinate with the Owner to ensure that new components have appropriate network connections.
- D. Coordinate with the Owner to ensure that new components will be properly programmed into the system.
- E. Change default passwords to new custom secure passwords as directed by the Owner.

3.07 ACCEPTANCE TESTING

A. Final Test and Acceptance Plan

1. Develop a final test and acceptance plan to identify each new system component, intent of test, test method, and expected results.
2. Each component listed in the plan shall include space for test part signatures, brief comments, time of test and pass/fail check boxes.
3. Test all equipment, products, and devices in accordance with the plan to ensure completely operational and fully functional security systems. Submit a written final test and acceptance report for review and approval.
4. The report shall be submitted to the Owner's representative at least 30 days prior to the scheduled system acceptance test.
5. System acceptance of the access control system shall be conditioned upon successful completion and operational demonstration of all system functions and components as documented in the final test and acceptance report.

B. System Acceptance

1. System acceptance shall not occur until after the following activities have been successfully completed:
 - a) Correction of all deficiencies and punch list items noted on the final test and acceptance report.
 - b) Acceptance of final test and acceptance report.
 - c) Acceptance of all project close-out submittals.
 - d) Delivery of final project close-out documentation.
 - e) Successful training and demonstration, including operation of systems, systems administration, and system management.
 - f) Purging of Contractor user privileges and return of all credentials.

3.08 OWNER PERSONNEL TRAINING

A. On-site operator training:

1. Instruct operating staff in proper operation, including hands-on training.
2. Minimum of two, four-hour sessions covering the operations for each system installed.

3. Training sessions shall be provided to supervisors, end-user staff, security staff, maintenance personnel, IT personnel, and any other personnel designated by the Owner.
4. Provide training sessions on all work shifts, including day, evening, and night shifts.

B. On-site administrator training:

1. Instruct security system administrators for each system installed, including hands-on training.
2. Minimum of two, four-hour sessions covering the operations for each system installed.
3. Training shall cover all administrative and management functions, including features and controls, for each system.

END OF SECTION

SECTION 28 46 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SCOPE

This specification section provides the requirements for the installation, programming and configuration of a complete code compliant Honeywell Farenhyt Series IFP-2100ECS digital protocol, analog, addressable fire alarm system with integrated Emergency Voice/Alarm Communication System capabilities (EVACS). This system shall include, but not be limited to, system cabinet, power supply, voice command module, microphone, built in Signaling Line Circuit (SLC), 160 character LCD annunciator, eight programmable Flexputs™, built in dual phone line, IP and optional cellular digital communicator associated peripheral devices, batteries, wiring, conduit and other relevant components and accessories required to furnish a complete and operational life safety system.

The contractor shall furnish and install a 24VDC analog addressable fire alarm system with integral Emergency Voice/Alarm Communication System, IDP protocol addressable initiation devices and System Sensor two-wire synchronized visual notification devices, as indicated on the contract drawings. This system is the Board of Education approved District Standard for Fire Alarm Systems. The Fire Alarm System shall be UL 864, 9th edition compliant and California State Fire Marshal listed.

- A. By submission of a Prime Bid for this project, the Prime Bidder assumes complete and total responsibility for himself and his subcontractors' compliance with this specification in its entirety. If found to be not in compliance with any part of this specification, the Prime Bidder shall bear any burden, financial or otherwise, required to complete the work of this specification to the total satisfaction of Owner.
1. The Fire Alarm System shall be furnished and installed by a Honeywell Farenhyt Series Engineered Systems Distributor who has been accepted, as a member in good standing, to the Honeywell Elite Partner Program at the time of the bid. Upon demand by the owner or his representative, the Prime Contractor shall provide proof that he or his listed subcontractor was a Farenhyt Series Engineered Systems Distributor who has been accepted, as a member in good standing, to the Honeywell Elite Partner Program at the time of the bid. Failure to produce said proof shall render the Prime Contractor's bid non-responsive and shall be considered grounds for immediate disqualification of his prime bid.
 - a. The Farenhyt Series Engineered Systems Distributor who has been accepted, as a member in good standing, to the Honeywell Elite Partner Program shall furnish all labor, materials, appliances, cabling, tools, equipment, facilities, transportation and services necessary for and incidental to the performance of all operations in connection with furnishing, delivery and installation of all equipment, cabling, programming, configuration, testing and training required by this Section, complete as indicated in the applicable Contract Drawings and/or specified herein.

- 1) Systems furnished and/or installed by contractors who are not Farenhyt Series Engineered Systems Distributors who have been accepted, as a member in good standing, to the Honeywell Elite Partner Program shall be considered in non-compliance with this specification and subject to replacement at the expense of the Prime Contractor.
- B. This specification provides the requirements for the installation, programming, configuration, testing and maintenance of a complete analog addressable fire alarm system. This system shall include, but shall not be limited to:
 1. Main Fire Alarm Control Panel (FACP)
 - a. Network Nodes (on network systems only)
 - 1) Network Interface Module
 - 2) Fiber optic or copper network connection circuits
 - b. System cabinet
 - c. Power supply
 2. Digital Signaling Line Circuits (SLC)
 3. Notification Appliance Circuits (NAC)
 4. RS-485 Serial Communication Bus (S-bus)
 5. Voice Communication Bus (V-bus, on systems with voice evacuation only)
 6. Annunciators both integral and remote
 7. Batteries
 8. Wiring
 9. Conduit
 10. Associated peripheral devices and modules
 11. Other relevant components and accessories required to furnish and install a complete and operational fully automatic, addressable reporting Life Safety System.
- C. The fire alarm system shall be capable of providing, at a minimum, the following:
 1. Fire Alarm Control Panel (FACP)
 - a. Integral Digital Alarm Communications Transmitter (DACT).
 - b. Network Interface capability via copper and/or fiber optic network.
 2. Analog addressable initiation devices
 3. Analog addressable monitor and/or control modules
 4. Notification appliances
 - a. Compatible with combination horn/strobe two-wire synchronized circuit.
 5. Notification Appliance Circuit (NAC) remote power supply
 - a. RPS-1000 Remote Power Supply shall provide the capability of housing the 6815 SLC Expander for remote SLC generation.
 - b. Combination horn/strobe two-wire circuit.
 - c. Built-in synchronization capabilities

6. Integral Emergency Voice/Alarm Communication System.
 - a. ECS Series Amplifiers
7. Firefighter Telephone capability
- D. Any material and/or equipment necessary for the proper operation of the system, which is not specified or described herein, shall be deemed part of this Specification.
- E. The Analog Addressable Fire Alarm System specified herein shall be connected to a UL Listed Central Station Monitoring Company via UL and California State Fire Marshal listed radio transmitter.
- F. Contractor shall offer fire alarm system inspection and maintenance contract.

1.02 QUALIFICATIONS

A. Equipment

1. This specification is based on the equipment of manufacturer(s) who have been approved by the Owner and the Manufacturer(s) herein named shall be considered as meeting the requirements of this specification.
2. The equipment manufacturer shall be a United States manufacturer, who has been regularly engaged in the manufacture of fire alarm systems for at least twenty-five (25) years.
3. The District Standard for Fire Alarm Systems is Honeywell Farenhyt Series IFP-2100ECS.
 - a. Equipment provided for this project shall be the product of Honeywell Farenhyt Series. No substitutions shall be approved.
 - 1) Contact Honeywell Fire Systems Sales Manager for the Southern California Region, Kasey Nelson (650) 381-4337 for a list of Farenhyt Engineered Systems Distributors that have been accepted, as a member in good standing, to the Honeywell Farenhyt Series Elite Partner Program for the Southern California Area.
4. It is the Contractor's responsibility to meet the entire intent of these specifications. Deviations from the specified items shall be at the risk of the Contractor until the date of final acceptance by the Architect of Record, Engineer of Record and the Owner's representative. All costs for removal, relocation or replacement of a substituted item shall be at the risk of the Prime Contractor.
5. All equipment shall conform to currently adopted applicable codes and ordinances.
6. All equipment shall be California State Fire Marshal (CSFM) listed.
7. All equipment shall bear the label of a Nationally Recognized Testing Laboratory (NRTL) such as Intertek Testing Services NA, Inc. (ITSNA - formerly ETL) or Underwriters Laboratories Inc. (UL) and be listed by their re-examination service.

B. System Supplier/Installer

1. The system shall be furnished and installed by a Farenhyt Engineered Systems Distributor who has been accepted, as a member in good standing, to the Honeywell Elite Partner Program who is trained and certified by the Manufacturer

in the proper installation, programming, configuration, testing, service and maintenance of the systems specified herein.

2. Subsequent to a successful bid and upon request of the Owner the System Supplier/Installer shall submit a qualification documentation package which shall include the following:
 - a. Evidence of current status as a Honeywell Farenhyt Series Engineered Systems Distributor who has been accepted, as a member in good standing, to the Honeywell Farenhyt Series Elite Partner Program.
 - b. Certificates indicating that a minimum of four (4) technicians have attended and completed all requirements of the IFP-2100/IFP-2100ECS training course.
 - c. A list of twenty (20) completed projects of equal scope, with associated Owners Representative contact names and telephone numbers.
 - d. Evidence of current State of California Contractor's License, C-10.
 - e. Per California law all individuals involved in the installation of the fire alarm system shall hold a valid State of California, Division of Apprenticeship Standards (DAS), Fire/Life Safety Technician Certification.
 - 1) Evidence of DAS certification shall be provided immediately upon request at the project site.
 - f. The System Supplier/Installer shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection, service and maintenance of the system.
 - g. The System Supplier/Installer shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.
 - h. The System Supplier/Installer shall be prepared to offer a service contract for the maintenance of the system beyond the warranty period.
 - i. The System Supplier/Installer shall provide proof that they maintain a complete service and maintenance center within 50 miles of the project address. A complete service center shall include replacement parts in stock in the quantities deemed sufficient by the owner, or its representatives.

1.03 RELATED SPECIFICATIONS

- A. The conditions of the General Contract (General, Supplementary, and other Conditions) and the Division 1 - General Requirements specifications are hereby made a part of this Section.

1.04 RELATED WORK BY OTHERS

- A. Reference Part 3, sub-section 3.01 of this specification.

1.05 RELATED DOCUMENTS

- A. In the event of a conflict between this specification and the construction drawings this specification shall take precedence.

1.06 APPLICABLE CODES & STANDARDS

- A. The Fire Alarm System shall comply with the currently adopted versions of the following:
 - 1. Building Standards Administrative Code, Part 1, Title 24, California Code of Regulations
 - 2. California Building Code (CBC) Part 2, Title 24, California Code of Regulations (International Building Code, with California Amendments)
 - 3. California Electrical Code (CEC) Part 3, Title 24, California Code of Regulations (National Electrical Code with California Amendments)
 - 4. California Mechanical Code (CFC) Part 4, Title 24, California Code of Regulations (Uniform Mechanical Code with California Amendments)
 - 5. California Fire Code (CFC) Part 9, Title 24, California Code of Regulations (International Fire Code with California Amendments)
- B. NFPA Standards
 - 1. The fire alarm system shall comply with the applicable provisions of the following current National Fire Protection Association (NFPA) standards:
 - a. NFPA 12 Carbon Dioxide Extinguishing Systems
 - b. NFPA 12A Halon 1301 Fire Extinguishing Systems
 - c. NFPA 13 Installation of Sprinkler Systems
 - d. NFPA 15 Water Spray Fixed Systems
 - e. NFPA 16 Foam-Water Sprinkler Systems
 - f. NFPA 17 Dry Chemical Extinguishing Systems
 - g. NFPA 17A Wet Chemical Extinguishing Systems
 - h. NFPA 72, National Fire Alarm and Signaling Code:
 - 1) Central Station Fire Alarm Systems
 - 2) Local Fire Alarm Systems
 - 3) Auxiliary Fire Alarm Systems
 - 4) Remote Station Fire Alarm Systems
 - 5) Proprietary Fire Alarm Systems
 - i. NFPA 90A, Installation of Air Conditioning and Ventilating Systems
 - j. NFPA 101, Life Safety Code - Safety to Life from Fire in Buildings and Structures
 - k. NFPA 750 Water Mist Fire Protection Systems
 - l. NFPA 2001 Clean Agent Fire Extinguishing Systems
- C. ADA - Americans with Disabilities Act
- D. CAC – California Administrative Code, Title 24
- E. U.L. Standards
 - 1. The system shall comply with the applicable provisions of the following U.L. Standards and Classifications:
 - a. UL 38, Manual Signaling Boxes for Fire Alarm Systems

- b. UL 268, Smoke Detectors for Fire Alarm Systems
- c. UL 268A, Smoke Detectors for Duct Applications
- d. UL 346, Waterflow Indicators for Fire Protective Signaling Systems
- e. UL 464, Audible Signal Appliances
- f. UL 521, Heat Detectors for Fire Protective Signaling Systems
- g. UL 864, Control Units and Accessories for Fire Alarm Systems
- h. UL 1480, Speakers for Fire Alarm Use
- i. UL 1481, Power Supplies for Fire Protective Signaling Systems
- j. UL 1635, Digital Alarm Communicator System Units
- k. UL 1638, Visual Signaling Appliances
- l. UL 1971, Signaling Devices for the Hearing Impaired
- m. UOJZ, Control Units, System
- n. SYZV, Control Units, Releasing Device
- o. UOXX, Control Unit Accessories, System
- p. SYSW, Accessories, Releasing Device Service

1.07 SUBSTITUTIONS

- A. Honeywell Farenhyt Series is the District Standard for Fire Alarm Systems. No substitutions shall be approved.

1.08 SUBMITTALS

- A. Within thirty-five (35) calendar days after the date of the award of the contract, the Contractor shall submit to the Architect for review, one (1) electronic copy, in pdf format, of a complete Submittal Package.
 - 1. Contractor Qualifications
 - a. Title Page
 - 1) Project Title
 - 2) Owner's name
 - 3) Architect's name
 - 4) Electrical Engineer's name
 - 5) Construction Manager's name (if applicable)
 - 6) Prime Contractor's name
 - b. Valid State of California Contractors License C-10
 - c. Manufacturer's Certifications
 - 1) Honeywell Farenhyt Series Engineered Systems Distributor who has been accepted, as a member in good standing, to the Honeywell Elite Partner Program
 - 2) Honeywell Farenhyt Series Certified Technician for IFP-2100/IFP-2100ECS
 - 3) A substantial list (minimum of 20) of completed projects equal in scope to that specified herein.
 - 4) Contact information shall be made available upon request.

2. Compilation of Submittal Contents
 - a. Each Specification Section of the Submittal Package shall be compiled in a separate pdf file.
 - 1) The filename shall include the specification section number.
3. Product Data
 - a. Comprehensive list of Equipment Data Sheets
 - b. Manufacturer's Data Sheets including cable types
 - c. California State Fire Marshall Listing sheets for all applicable equipment and materials.
4. Shop Drawings
 - a. 1/8" scale shop drawings including all site plans, floor plans and wiring diagrams shall be submitted separate from the Product Data submittal.
 - 1) EXCEPTION – K-12 school projects with DSA Approved plans and specifications shall not require shop drawing submittal due to the fact that contractor revisions to DSA Approved plans and specifications are prohibited by DSA. No changes to DSA Approved documents shall be made by the contractor regardless of shop drawing requirements included in other parts of the drawings or specifications.

PART 2 PRODUCTS

2.01 SYSTEM REQUIREMENTS

A. Basic Performance and Capabilities

1. System shall be fully programmable and configurable on site to accommodate system expansions and facilitate changes in operation.
2. All software programs shall be stored in non-volatile programmable memory within the FACP.
 - a. Loss of primary and secondary power shall not erase the instructions stored in the memory.
 - b. System programming shall be password protected.
3. Alarm, supervisory and trouble signals from analog addressable devices shall be encoded onto NFPA Class B signaling line circuits (SLC).
4. Initiation device circuits (IDC) shall be wired NFPA Class B.
5. Notification appliance circuits shall be wired NFPA Class B.
6. A single ground or open on any system SLC, IDC or NAC shall not cause a system malfunction, loss of operating power or the ability to report an alarm.
7. Alarm signals arriving at the main FACP shall not be lost due to a power failure.
8. Per NFPA 72, the system shall be provided with sufficient battery capacity to operate the entire system upon loss of 120 VAC power in a normal supervisory mode for a period of twenty four (24) hours with fifteen (15) minutes of alarm indication at the end of this period.

9. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate that complies with NFPA 72 section 10.6.10.3.
- B. System Functional Operation
 1. The actuation of any approved alarm initiating device shall automatically initiate the following functions:
 - a. Alarm LED on the FACP shall flash.
 - b. Local audible piezo electronic signal in the FACP shall sound.
 - c. The alarm condition description, including the type of point and the location within the protected premises, shall be displayed on the LCD display at the FACP and any remote annunciator(s).
 - d. System shall transmit the condition to a UL Listed Central Station Monitoring Facility. Supervising station shall be approved per CFC section 907.6.5.3 (2013).
 - e. Printing and history storage equipment shall log the information associated with the condition, including the time and date of the alarm occurrence.
 - f. System output programs configured via control-by-event (CBE) programming to be activated by the particular point in alarm shall be executed, and the associated system output (alarm notification appliances and relays) shall be activated on either local outputs or points located on other network nodes.
 2. The actuation of any approved supervisory alarm initiating device shall automatically initiate the following functions:
 - a. Supervisory LED on the FACP shall flash.
 - b. Local audible piezo electronic signal in the FACP shall sound.
 - c. The supervisory condition description, including the type of point and the location within the protected premises, shall be displayed on the LCD display at the FACP and any remote annunciator(s).
 - d. System shall transmit the condition to a UL Listed Central Station Monitoring Facility. Supervising station shall be approved per CFC section 907.6.5.3 (2013).
 - e. Printing and history storage equipment shall log the information associated with the condition, including the time and date of the supervisory alarm occurrence.
 - f. System output programs configured via control-by-event (CBE) programming to be activated by the particular point in supervisory alarm shall be executed, and the associated system outputs (relays) shall be activated on either local outputs or points located on other network nodes.
 3. Whenever a trouble condition is detected and reported the FACP shall automatically initiate the following functions:
 - a. Trouble LED on the FACP shall flash.
 - b. Local audible piezo electronic signal in the FACP shall sound.

- c. The trouble condition description, including the type of point and the location within the protected premises, shall be displayed on the LCD display at the FACP and any remote annunciator(s).
- d. System shall transmit the condition to a UL Listed Central Station Monitoring Facility. Supervising station shall be approved per CFC section 907.6.5.3 (2013).
- e. Printing and history storage equipment shall log the information associated with the condition, including the time and date of the trouble condition occurrence.
- f. System output programs configured via control-by-event (CBE) programming to be activated by the particular point in trouble condition shall be executed, and the associated system outputs (relays) shall be activated on either local outputs or points located on other network nodes.

C. Test Functions

- 1. A “Lamp Test” or “Indicator Test mode shall be a standard feature of the FACP and shall test all LED’s and the LCD display on the main FACP and remote annunciators.
- 2. A “Walk Test” mode shall be a standard feature of the FACP.
 - a. The Walk Test feature shall function so that each alarm input tested shall operate the associated notification appliance for two seconds. The FACP will then automatically reset and confirm normal device operation.
 - b. The event memory shall contain the information on the point tested, the zone tripped, the zone restore and the individual point’s return to normal.
- 3. A “Fire Drill mode shall allow the manual testing of the Fire Alarm System notification circuits. The Fire Drill shall be capable of being initiated at the main annunciator, remote annunciators and via a remote contact input.
- 4. “Bypass Mode” shall allow for any point or NAC circuit to be bypassed without affecting the operation of the total Fire Alarm System.

D. Remote Monitoring Connection

- 1. The fire alarm system shall be connected via Digital Alarm Communicator Transmitter (DACT) and an NFPA 72, Chapter 26 compliant transmission channel(s) to a UL Listed Central Station Monitoring Company.
 - a. The fire alarm control panel shall provide an integral Digital Alarm Communicator Transmitter (DACT) for signaling to a UL Listed Central Station Monitoring Company.
 - 1) The fire alarm system shall transmit alarm, supervisory alarm and trouble signals with the alarms having priority over the trouble signal.

2.02 SYSTEM COMPONENTS

A. Fire Alarm Control Panel (FACP)

- 1. The FACP shall be a Honeywell Farenhyt Series IFP-2100ECS
 - a. The basic control panel shall provide:

- 1) 9-amp power supply expandable to 45 amps via bus connected expander modules
- 2) Network Interface Module (only required if this system is to be a part of a network)
 - (a) The network interface module shall be a Honeywell Farenhyt Series IFP-RPT-FO-KIT Network Repeater KIT for fiber optic or unshielded twisted pair cable connections.
 - (1) 16AWG unshielded twisted pair FPL (SLC) cable shall be used for copper wiring network connections up to a maximum distance of 3000 feet.
 - (2) 6-strand, 62.5/125 micron multimode fiber optic cable with ST connectors shall be used for fiber optic cable connections.
 - (i) Installers of fiber optic cable shall be certified by the manufacturer of the cable and connectivity used.
 - (ii) Fiber optic cable shall be tested utilizing and industry standardized method.
 - (iii) Provide fiber optic patch cables as required for a complete and operable system.
- 3) One (1) Signaling Line Circuit (SLC) capable of supporting 159 addressable detectors and 159 addressable modules
 - (a) Additional SLC's may be added via expander modules to a maximum of 2,032 addressable points per panel.
- 4) Eight (8) programmable "Flexputs"
 - (a) Programmable Flexput Circuits shall be capable of being programmed as supervised reverse polarity notification appliance circuits, supervised auxiliary power circuits (continuous or resettable), door holder power or as input circuits in Class A or Class B configuration to support dry contact devices or compatible two-wire smoke detectors
- 5) 160-character LCD annunciator
 - (a) Capability of supervising 8 additional remote annunciators
- 6) Integral UL listed Digital Alarm Communicator Transmitter (DACT)
- 7) Ability to automatically test smoke detectors in compliance with NFPA Standards to ensure that they are within listed sensitivity parameters
- 8) Compensation for accumulation of contaminants that affect detector sensitivity
- 9) Day/night sensitivity adjustments
- 10) Maintenance alert feature (differentiated from trouble condition)
- 11) Detector sensitivity selection
- 12) Over-current Protection
 - (a) All low-voltage circuits shall be protected by microprocessor-controlled power limiting or have a self-restoring polyswitch.
- 13) Ground Fault Detection

- (a) The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded.
 - (b) Ground fault shall not interfere with the normal operation of the system, such as alarm or trouble conditions.
 - 14) Auto-programming mode (Jumpstart)
 - (a) Jumpstart feature shall automatically enroll all properly connected devices into a functional system within 60 seconds of power up of the panel
 - 15) Ability to upgrade the core operating software on site or over the telephone
 - 16) RS-485 Serial Communication Bus (S-bus). Systems that do not communicate with Intelligent Modules via RS-485 Serial Communication Bus shall not be deemed equal and shall not be acceptable for this project.
 - (a) S-bus shall be of Class A or Class B configuration with a total bus length of 6000 feet.
 - 2. The FACP shall be capable of operating and supervising notification appliance devices as well as addressable initiating detection devices and an integrated supervised dual line digital communicator.
- B. Fire Alarm Control Panel with integral Emergency Voice/Alarm Communication System.
- 1. The Voice Evacuation Control Panel shall be Honeywell Farenhyt Series IFP-2100ECS.
 - a. The IFP-2100ECS shall be the FACP on all systems where Networking is not required (Small elementary schools and middle schools) for compliance with CFC required Emergency Voice/Alarm Communication in K -12 schools.
 - b. Remote Voice Evacuation Amplifiers shall be as indicated on plans:
 - 1) Honeywell Farenhyt Series Farenhyt ECS-50W
 - 2) Honeywell Farenhyt Series ECS-DUAL50W
 - 3) Honeywell Farenhyt Series ECS-125W.
- C. Network Nodes
- 1. Network Nodes, if required, shall be Honeywell Farenhyt Series IFP-2100 or IFP-2100ECS.
 - a. All Network systems shall have a maximum of one (1) IFP-2100ECS node for compliance with CFC required Emergency Voice/Alarm Communication in K -12 schools.
 - b. All Network Nodes shall have the capability of being connected with either copper cable or fiber optic cable.
- D. Remote Annunciator
- 1. The remote annunciator shall be Honeywell Farenhyt Series RA-2000
 - a. The remote annunciator shall have 160-character LCD display and 5 LED's for general alarm, supervisory, systems trouble, system silence and system power.

- b. The remote annunciator shall have the same control and display layout as the integrated annunciator at the FACP.
 - c. The remote annunciator shall have the same functionality and operation as the integrated annunciator at the FACP.
 - d. The remote annunciator shall have twenty (20) levels of user codes to limit access to the system to authorized individuals.
 - e. The remote annunciators shall be capable of operating at a maximum wiring distance of 6,000 feet from the control unit on unshielded, non-twisted cable.
 - f. The system shall support a maximum of eight (8) remote annunciators.
- E. The Serial/Parallel Interface Gateway Module shall be Honeywell Farenhyt Series 5824
 - 1. The 5824 shall be connected to the S-bus and provide serial and parallel ports for connection to peripheral devices.
- F. Remote Power Supply
 - 1. The Intelligent Remote Power Supply shall be Honeywell Farenhyt Series RPS-1000 or Honeywell Farenhyt Series 5496.
 - a. The Intelligent Remote Power Supply shall be connected to the FACP via S-bus.
 - 1) The RPS-1000 shall have the capability of accommodating all IFP-2100 add-on modules including the 6815XL SLC Expander.
 - 2) The RPS-1000 shall have 6 amps of output power, six flexput circuits rated at 3 amps each and two form C relay circuits rated at 2.5 amps at 24VDC.
 - 3) The 5496 shall have 6 amps of output power, 4 output circuits that may be programmed as NAC or Auxiliary Power.
 - b. The Intelligent Remote Power Supply shall act as a bus repeater allowing connection of additional S-bus devices to a maximum wiring distance of 6,000 feet from the power supply.
 - c. The Intelligent Remote Power Supply shall have on-board synchronization for System Sensor NAC devices.
 - 1) Horns and strobes shall be synchronized on the same two-wire NAC circuit.
- G. Signaling Line Circuit (SLC) Devices
 - 1. Each SLC shall be capable to accommodating 159 addressable detectors and 159 addressable modules.
 - 2. Provide SLC devices as indicated on the construction drawings. All devices shall be listed for compatibility with the IFP-2100 FACP.
 - a. SLC Isolation Module shall be Honeywell Farenhyt Series IDP-ISO.
 - 1) Isolation Modules shall be provided, as required, on SLC loops to protect adjacent loops from shorts and/or grounds.
 - b. Ceiling mounted smoke detector shall be Honeywell Farenhyt Series IDP-Photo-W.

- c. Ceiling mounted fixed temperature heat detector shall be Honeywell Farenhyt Series IDP-Heat-HT-W.
 - d. Ceiling mounted combination Fire/Carbon Monoxide Detector shall be Honeywell Farenhyt Series IDP-Fire/CO-W.
 - e. Attic mounted heat detector shall be Honeywell Farenhyt Series IDP-Heat-HT or System Sensor 5602 with IDP-Minimon Monitor Module.
 - f. Outdoor elevator lobby device shall be Weatherproof Conventional Heat Detector Thermotech #302-AW-135 with IDP-Minimon Monitor Module.
 - g. Addressable Relay Module shall be Honeywell Farenhyt Series IDP-Relay.
 - h. Addressable INonitor Module shall be Honeywell Farenhyt Series IDP-Monitor.
 - i. Addressable Mini Monitor Module shall be Honeywell Farenhyt Series IDP-Minimon.
 - j. Addressable Beam Detector shall be Honeywell Farenhyt Series IDP-Beam-T
 - k. Addressable Manual Pull Station shall be Honeywell Farenhyt Series IDP-Pull-DA.
 - l. Addressable Duct Mounted Smoke Detector shall be Honeywell Farenhyt Series IDP-PhotoR with DNR Housing and Sampling Tubes.
 - 1) Where allowed by code, addressable relay modules shall be utilized for code required HVAC unit shut down in lieu of duct mounted smoke detectors.
 - 2) Where allowed by code, addressable relay modules in conjunction with line-voltage isolation relays shall be utilized to control Fire/Smoke Damper power circuits, in lieu of duct mounted smoke detectors.
- H. Notification Appliance Circuit (NAC) Devices
- 1. NAC devices shall be the product of System Sensor. All devices shall be listed for compatibility with the IFP-2100 and IFP-2100ECS FACP.
 - a. Fire Alarm horn/strobe device
 - 1) Wall mount multi-candela horn/strobe shall be System Sensor P2RL, two-wire, red in color.
 - 2) Ceiling mount multi-candela horn/strobe shall be System Sensor PC2WL, two-wire, white in color.
 - b. Fire Alarm strobe only device
 - 1) Wall mounted multi-candela strobe shall be System Sensor SRL, red in color.
 - 2) Ceiling mount multi-candela strobe shall be System Sensor SCWL, white in color.
 - c. Fire Alarm speaker only device
 - 1) Wall mount speaker shall be System Sensor SPRL, two-wire, red in color.
 - 2) Ceiling mount speaker shall be System Sensor SPCWL, two-wire, white in color.
 - d. Fire Alarm speaker/strobe device

- 1) Wall mount multi-candela speaker/strobe shall be System Sensor SPSRL, red in color. (For use in Emergency Communications systems only)
- 2) Ceiling mount multi-candela speaker/strobe shall be System Sensor SPSCWL, white in color. (For use in Emergency Communications systems only)
- e. Exterior weatherproof Fire Alarm horn shall be System Sensor HRK, red in color.
- f. Exterior weatherproof speaker shall be System Sensor SPRK-R, red in color. (For use in Emergency Communications systems only)
- I. Line-Voltage Isolation Relay
 1. Line-Voltage Isolation Relay shall be System Sensor PR-1, Air Products PAM-1, MR101C or RIC-1.
 - a. All relays shall be California State Fire Marshal (CSFM) listed.
- J. System Wire/Cable
 1. All Fire Alarm System Wire and Cable shall be installed in conduit, unless noted otherwise.
 - a. Interior
 - 1) SLC cable shall be #16AWG, 2-conductor, unshielded, FPL, red jacket by Falcon Fine Wire #450216R, or equal.
 - (a) SLC cable shall be California State Fire Marshal (CSFM) listed.
 - 2) NAC Wire shall be #12 AWG THHN/THWN, stranded color red and black.
 - 3) S-bus cable shall be #16AWG, 4-conductor, unshielded, FPL, red or black jacket by Falcon Fine Wire #450416R, or equal.
 - (a) S-Bus cable shall be California State Fire Marshal (CSFM) listed.
 - 4) Speaker cable shall be #18AWG, 2-conductor, shielded, FPL, red jacket by Falcon Fine Wire #460218R, or equal.
 - (a) Speaker cable shall be California State Fire Marshal (CSFM) listed.
 - 5) Network Fiber Optic Cable shall be 6-strand 62.5/125 micron multimode Indoor/Outdoor OCC DX006DWLS9KR, or equal, with ST connectors.
 - b. Exterior
 - 1) SLC cable shall be #16AWG, 2-conductor, unshielded, FPL, water-blocked, black jacket by Falcon Fine Wire #400216H2O, or equal.
 - (a) SLC cable shall be California State Fire Marshal (CSFM) listed.
 - 2) NAC Wire shall be #12 AWG THHN/THWN, stranded color red and black.
 - 3) S-bus cable shall be #16AWG, 4-conductor, unshielded, FPL, water-blocked, black jacket by Falcon Fine Wire #400416H2O, or equal.
 - (a) S-Bus cable shall be California State Fire Marshal (CSFM) listed.
 - 4) Speaker cable shall be #18AWG, 2-conductor, shielded, FPL, water-blocked, black jacket by Falcon Fine Wire #410218H2O, or equal.
 - (a) Speaker cable shall be California State Fire Marshal (CSFM) listed.

- 5) V-Bus cable shall be #16AWG, 2-conductor, shielded, FPL, water-blocked, black jacket by Falcon Fine Wire #410216H2O, or equal.
 - (a) Speaker cable shall be California State Fire Marshal (CSFM) listed.
- 6) Network Fiber Optic Cable shall be 6-strand 62.5/125 micron multimode Indoor/Outdoor OCC #DX006DWLS9KR, or equal, with ST connectors.

PART 3 EXECUTION

3.01 DIVISION OF WORK

- A. While all work included under this specification is the complete responsibility of the Electrical Contractor, the division of actual work listed following shall occur.
 1. All conduits, pull cords, electrical pull boxes, grounding rods, outlet boxes, terminal cabinets, backboards, etc., which form part of the rough-in work shall be provided and installed completely by the Electrical Contractor. Coordinate as necessary for proper installation.
 - a. Equipment specific boxes provided by the system manufacturer shall be provided by System Supplier/Installer and installed by the Electrical Contractor.
 2. The balance of the system, including installation of initiating devices, notification appliances and equipment, making all connections, etc., shall be performed by the System Supplier/Installer.
 3. All 120VAC power conductors and conduits associated with power circuits to all fire alarm system equipment locations shall be provided and installed by the Electrical Contractor.
 4. An insulated stranded copper ground wire shall be provided from each control unit to the building grounding system, in compliance with CEC Article 250, by the Electrical Contractor.
 5. Labeling of pullboxes and terminal cabinets shall be provided and installed by the Electrical Contractor.
 6. HVAC Unit Shut-down
 - a. Conduit for code required HVAC unit shut-down shall be provided and installed by the Electrical Contractor.
 - b. Conductors for code required HVAC unit shut-down shall be provided, installed and terminated by the Mechanical Contractor.
 - c. Addressable Relay Modules for code required HVAC unit shut-down shall be provided and installed by the Fire Alarm System Supplier/Installer.

3.02 INSTALLATION

- A. All work shall be completed in strict accordance with all applicable codes and ordinances, by a Honeywell Farenhyt Series Engineered Systems Distributor who has been accepted, as a member in good standing, to the Honeywell Elite Partner Program.
- B. Cable/Wire
 1. All cable/wire for the system specified herein shall be new, unless otherwise noted on plans.

2. System cable/wire and equipment installation shall be in accordance with good engineering practices as established by the California Electrical Code (CEC). Wiring shall meet all applicable electrical codes. All cable/wire shall test free from all grounds and shorts.
 - a. All cable/wire shall be continuous between terminals with no splices.
3. All cable/wire shall be labeled at all points of termination. All labeling shall be based on the room numbers as provided by the District/Owner or his representative.
4. Underground cables
 - a. Any cable/wire pulled through manholes or pullboxes located below grade, shall be continuous between terminals with no splices underground. The cable/wire shall be intact with no cuts in the protective outer jacket.
 - b. All cable/wire in underground vaults/boxes shall be neatly dressed with service loops attached to the sides of the vault/box. Cable/wire shall not come in contact with the ground.

3.03 SYSTEM START-UP

- A. All start-up programming and system commissioning shall be performed by a manufacturer's trained and certified technician currently employed by the System Supplier/Installer.

3.04 SYSTEM VERIFICATION

- A. Subsequent to system start-up the system installer shall perform a 100% system pre-test to verify that the following features are functioning properly.
 1. All notification appliances
 2. All initiation devices
 3. All control modules
 4. All monitor modules
 5. Communication link to monitoring service

3.05 ACCEPTANCE TESTING

- A. The system installer shall, in the presence of the Inspector of Record (IOR), perform 100% testing as noted in System Verification above.

3.06 IN SERVICE TRAINING

- A. The Contractor shall instruct personnel designated by the Owner in the proper use, basic care and maintenance of the system beyond the warranty period. Contractor shall provide up to eight hours of in-service training with this system.

3.07 FACTORY TRAINING & CERTIFICATION

- A. When requested by Owner, provide Factory Training for a maximum of two District Technicians.

3.08 RECORD DRAWINGS AND CLOSE-OUT DOCUMENTATION

- A. System supplier/installer shall update the General Contractor's master set of record drawings kept on site once per week, minimum.
- B. Contractor shall provide the following at close-out.
 - 1. One (1) electronic (pdf) copy of manufacturer's maintenance and operation manuals.
 - 2. Three (3) wet signed copies of system warranty.

3.09 WARRANTY

- A. The Contractor shall warrant the equipment and/or materials to be new and free from defects in material and workmanship, and will, within three (3) years from the date of final acceptance, repair or replace any equipment and/or materials found to be defective. This warranty shall not apply to any equipment or materials that have been subject to misuse, abuse, negligence or modification by owner or contractors other than the original installer that provided this warranty.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing retaining walls, chain link fence, gate, sewer manhole, concrete pavement to remain.
2. Removing existing grass
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Temporary erosion and sedimentation control measures.

1.2 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site-clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.

3.5 CLEARING AND GRUBBING

- A. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of eight inches and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

3.8 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 31 10 00

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Base course for concrete walks pavements.
5. Base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

1.2 QUALITY ASSURANCE

A. Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC), latest edition and supplements for rock materials. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.3 REFERENCES

A. This specification section has been prepared using the project soils report as a reference.

1.4 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Type "B" Material: Backfill placed beside pipe in a trench, including haunches to support sides of pipe.
2. Initial Backfill: Backfill placed over pipe in a trench.
3. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subgrade and hot-mix asphalt or concrete paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Classified Excavation: Removal and disposal of materials not defined as rock

- F. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- H. Fill: Soil materials used to raise existing grades.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- K. Unclassified Excavation: Removal and disposal of materials encountered regardless of nature of materials, including rock.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 PROJECT CONDITIONS

- A. Examine site, Drawings, records of existing utilities and construction, record of test borings, and subsurface exploration report available from Owner. Records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.

1.6 PROTECTION

- A. Soils Consultant: A geotechnical consultant shall advise on Construction techniques involved in work, including design, checking and approving of temporary bracing, sheeting, shoring, underpinning and other items pertinent to work, and encountered during prosecution of work. Consultant shall be primarily concerned with construction methods, which will prevent settlement or damage to surrounding structures, sidewalks, embankments, utilities and roads on Owner's property and adjoining properties.
- B. Existing Utilities:

1. Maintain existing utilities that are to remain in service. Before excavating over or adjacent to existing utilities, notify utility Owner to ensure protective work will be coordinated and performed in accordance with utility Owner's requirements. If existing service lines, utilities and utility structures, which are to remain in service, are uncovered or encountered during these operations, safeguard and protect from damage.
 2. Within limits of excavation, remove existing piping, subsoil drainage systems, conduit, manholes and relocated items, which are to be abandoned. Plug open ends of utilities to remain with concrete.
 3. Re-route existing subsoil drains which obstruct work around new constructions or incorporate them into new drainage systems.
 4. Consult Architect immediately for directions, should uncharted or incorrectly charted piping or other utilities be encountered during excavation. Cooperate with Owner and public and private utility companies in keeping their respective services, utilities and facilities in operation. If damaged, repair utilities to satisfaction of Architect and utility Owner.
- C. Existing Facilities: Protect and maintain in satisfactory manner, existing pavements, curbs, gutters, structures, conduits, fences, walls and other facilities to remain above and below grade. Restore facilities damaged by construction operations.
- D. Pumping and Draining: Excavate areas in such manner as to afford adequate drainage. Control grading in vicinity of excavated areas so ground surface will slope to prevent water running into excavated areas. Until work is completed, remove water from areas of construction that may interfere with proper performance of work or that may result in damage to the soil sub-grade and provide sumps, pumps, well points, electric power and attendance required for this purpose on a 24-hour basis if necessary. Protect construction from water during construction, including prevention of erosion of completed work during construction and until permanent drainage and erosion controls are operational. Repair adjoining properties, facilities and streets damaged due to improper protection.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Sand, gravel, friable earth, or non-expansive clays, subject to Testing Laboratory's approval. Fill and backfill material shall be free of organic material, slag, cinders, expansive soils, trash or rubble and stones having maximum dimension greater than **[six inches]**.
- C. Unsatisfactory Soils: Expansive and other soils as defined in the project's geotechnical investigation report.
 1. Unsatisfactory soils also include satisfactory soils not maintained within two percent of optimum moisture content at time of compaction.

- D. Base Course: Material conforming to SSPWC section 200-2.2, Crushed Aggregate Base or SSPWC section 200-2.4 Crushed Miscellaneous Base.
- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a one and one-half-inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Bedding Course:
 - 1. Flexible pipes: clean coarse sand.
 - 2. All other pipes: crushed rock conforming to subsection 200-1.2 and Table 200-1.2.1 (A) of the "Standard Specifications for Public Works Construction." For pipes up to and including 15 inches, maximum rock gradation shall be one-half inch. For pipes over 15 inches, maximum rock gradation shall be three-fourths inch.
- G. Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a one and one-half-inch sieve and zero to five percent passing a No. 8 sieve.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, six inches wide and four mils thick, continuously inscribed with a description of the utility. Color coding shall be according to the American Public Works Association (APWA) standards:
 - 1. Blue – Potable water and fire suppression lines.
 - 2. Green – Sanitary sewer and storm drain lines
 - 3. Orange – Communication, alarm or signal lines
 - 4. Purple – Reclaimed water, irrigation, and slurry lines
 - 5. Red – Electrical power lines, cables, conduit and lighting lines
 - 6. Yellow – Gas, oil, steam, petroleum, or gaseous material lines.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing" or "Demolition."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing" or "Demolition," during earthwork operations.

3.2 EXCAVATION

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus one inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide six-inch clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. Excavate trenches six inches deeper than elevation required in rock or other unyielding bearing material, four inches deeper elsewhere, to allow for bedding course.

3.6 SUBGRADE INSPECTION

- A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2,500 pounds per square inch (psi), may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section Cast-in-Place Concrete.
- D. Provide four-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of four inches of concrete before backfilling or placing roadway base.
- E. Place and compact initial backfill of satisfactory soil, free of particles larger than one and a half inches in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Install warning tape directly above utilities, minimum six inches above top of pipe, minimum 12 inches below finished grade, except six inches below subgrade under pavements and slabs.

3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than one vertical to four horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use engineered fill.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within two percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by two percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials per geotechnical report recommendations and not less than the percentages of maximum dry unit weight according to ASTM D 1557.
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact existing subgrade and each layer of backfill or fill soil material per the geotechnical report recommendations.
 - 2. Under walkways, scarify and recompact subgrade and compact each layer of backfill or fill soil material per the geotechnical report recommendations.
 - 3. Under lawn or unpaved areas, scarify and recompact top six inches below subgrade and compact each layer of backfill or fill soil material per the geotechnical report recommendations.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material per the geotechnical report recommendations.

3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus one inch.
 - 2. Walks: Plus or minus one inch.
 - 3. Pavements: Plus or minus one-half inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of one-half inch when tested with a 10-foot straightedge.

3.14 BASE COURSES

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under pavements and walks as follows:
 - 1. Shape base course to required crown elevations and cross-slope grades.
 - 2. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than [95] percent of maximum dry unit weight according to ASTM D 1557.

3.15 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Place drainage course that exceeds six inches in compacted thickness in layers of equal thickness, with no compacted layer more than six inches thick or less than three inches thick.
 - 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 20 00

SECTION 32 12 16

HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes hot-mix asphalt paving, patching, and paving overlay.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Material certificates.
- D. Log of placement of asphalt, including dates, times, temperature readings and other pertinent information.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC) and the California Department of Transportation (Caltrans), latest editions and supplements for asphalt paving work. These Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.
- C. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 60 degrees Fahrenheit.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 degrees Fahrenheit and rising at time of placement.

3. Asphalt Surface Course: Minimum surface temperature of 60 degrees Fahrenheit at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees Fahrenheit for oil-based materials, 50 degrees Fahrenheit for water-based materials, and not exceeding 95 degrees Fahrenheit.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Coarse and fine aggregate shall conform to SSPWC section 203-6.2.2. Mineral filler, if required, shall conform to SSPWC section 203-6.2.4.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: Paving asphalt, viscosity grade [PG 64-10] conforming to Section 92 of the Caltrans Standard Specifications.
- B. Tack Coat: [PG 64-10] conforming to Section 92 of the Caltrans Standard Specifications.
- C. Mixes: Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mix III-C3 PG 64-10 designed in conformance with SSPWC Section 203-6.5.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with Caltrans Standard Specifications - Section 84 (Federal Specification No. TT-P-1952 for Blue, Red and Green paint; and State of California Standard Specification No. PTWB-01 for White, Yellow and Black paint) with drying time of less than 45 minutes.
 1. Color: As indicated.
- C. Wheel Stops: Precast, air-entrained concrete
 1. Dowels: Galvanized steel, ½ inch diameter, 18-inch minimum length.

PART 3 - EXECUTION

3.1 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - 1. Mill to a depth of two inches.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gallons/square yard.
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

3.3 SURFACE PREPARATION

- A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gallons/square yard.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Spread mix at minimum temperature of 250 degrees Fahrenheit.
 - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 degrees Fahrenheit.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- F. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus one-half inch.
 2. Surface Course: Plus one-fourth inch (no minus).
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
1. Base Course: One-fourth inch.
 2. Surface Course: One-eighth inch.
 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is one-fourth inch.

3.7 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.8 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel one inch beneath top of wheel stop.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 32 12 16

SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, including admixtures.
- B. Design Mixtures: For each concrete pavement mixture.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- C. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.
- D. The Contractor shall have one copy of the Standard Specifications at the job site.
- E. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and pavement sections do not apply to this document.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type II, low alkali. Supplement with the following:
 - a. Pozzolan: ASTM C618, Class F or N Fly Ash, 100 pounds maximum per cubic yard, containing one percent or less carbon. Fly ash shall not be used in excess of 15 percent by weight of total cement quantity.
- B. Combined Aggregates: Gradation "C" conforming to SSPWC Section 201-1.3.2.
- C. Water: ASTM C 94/C 94M.

2.3 CURING MATERIALS

- A. Liquid Curing Compound: ASTM C309, fugitive dye dissipating type, complying with Rule II 13 of the South Coast Air Quality Management District and Federal Air Quality Regulation 40 CFR 52.254.
- B. Moisture-Retaining Cover (Curing Sheet): ASTM C 171, non-staining polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

2.4 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with Caltrans Standard Specifications - Section 84 (Federal Specification No. TT-P-1952 for Blue, Red and Green paint; and State of California Standard Specification No. PTWB-01 for White, Yellow and Black paint) with drying time of less than 45 minutes.

2.5 WHEEL STOPS

1. Dowels: Galvanized steel, three-fourths-inch diameter, 24-inch minimum length.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:

1. Compressive Strength (28 Days): Minimum 2,500 pounds per square inch (psi) maximum 3,250 pounds per square inch (psi)
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.60.
3. Slump Limit: Four inches, plus or minus one inch.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates to Architect for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

- A. General: Form construction, isolation, and control joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
- D. Control Joints: Form weakened-plane control joints, sectioning concrete into areas as indicated. Within 24 hours of pour, construct control joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete pavement.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a one-fourth-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- D. Screed pavement surfaces with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
 - 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface one-sixteenth to one-eighth inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.

1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 pounds/square feet x h before and during finishing operations. Apply according to manufacturers written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these methods.

3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances as follows
 1. Elevation: One-fourth inch.
 2. Thickness: Plus three-eighths inch minus one-fourth inch.
 3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed one-fourth inch.
 4. Joint Spacing: Three inches.
 5. Contraction Joint Depth: Plus one-fourth inch no minus.
 6. Joint Width: Plus one-eighth inch, no minus.

3.9 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel one inch beneath top of wheel stop.

3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 14
DECORATIVE CONCRETE FINISHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Decorative Concrete Finishes
 - 2. If this Section conflicts with Related Sections:
 - a. This Section takes precedence for matters that affect concrete appearance.
 - b. Related Sections take precedence for matters that do not affect concrete appearance.
 - c. In case of conflicts, notify Landscape Architect for clarification.
 - 3. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.
- B. Related Sections
 - 1. Related Site Cast Concrete Sections:
 - a. Division 03 Section Cast-in-Place Concrete: Basic requirements for concrete and coordination of sample submittal.
- C. Reference Standards
 - 1. ACI 117 – Tolerances for Concrete Construction and Materials
 - 2. ACI 301 – Structural Concrete.
 - 3. ACI 303.1 – Cast-in-Place Architectural Concrete.
 - 4. ACI 305.1 – Hot Weather Concreting.
 - 5. ACI 308R – Curing Concrete.
 - 6. ACI 318 – Building Code Requirements for Structural Concrete.
 - 7. ACI 347 – Formwork for Concrete]
 - 8. ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete.
 - 9. ASTM C979 – Pigments for Integrally Colored Concrete.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Curing products.
 - 2. Proprietary cleaning agents
 - 3. Surface retarders
- B. Shop Drawings:
 - 1. Indicate extent of each concrete finish
 - 2. Control joint and expansion joint layout.
- C. Samples for Initial Selection: Submit a six inch by six-inch sample of each finish for initial selection.
- D. Samples for Verification: Submit sample chip of specified concrete colors indicating manufacturer's color name.
- E. Mock up sample 8'x8' showing finish, textures, and jointing (sawcuts) of each type of concrete finish.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.7 QUALITY ASSURANCE

- A. Perform work in accordance with: ACI 301, ACI 303.1, ACI 305.1, ACI 306.1, ACI 318 in addition to ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete. And ASTM C979 – Pigments for Integrally Colored Concrete.
- B. Obtain each material from same source and maintain high degree of consistency in workmanship throughout Project.
- C. Installer Qualifications: Concrete work shall be by firm with five years' experience with work of similar scope and quality.
- D. Mockup:
 - 1. Provide full-scale mock-up under Division 01 Section "Quality Requirements". Construct at least one month before start of other concrete work to allow concrete to cure before observation.
 - 2. At location acceptable to Landscape Architect, demonstrate methods used for construction, including forming and finishing conditions required for Project using materials, workmanship, joint treatments, and curing methods to be used throughout Project.
 - 3. Accepted mock-up provides visual standard for work of Section.
 - 4. Mock-up may remain as part of Work. Remove mock-up when no longer required for comparison with finished work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Color Additive: Deliver, store, and handle in accordance with manufacturer's instructions.
- B. Concrete: Schedule delivery to provide consistent mix times from time color additive is placed in mixture until placement of integrally colored concrete.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. Mix Design
 - 1. As required by local building codes or industry standards. Water cement ratio not to exceed 0.50. (0.45 water cement ratio as required for salt water exposure)
 - 2. Cement: per ASTM C 150, C595 or C1157.
 - 3. Aggregate: per ASTM C 33 (non-reactive), 45% 1" Aggregate and 10% 3/8" Aggregate and 45% Concrete Sand.
 - 4. MasterBuilders F100 Fiber at 1.5#/CY
- B. Integrally Mixed Color: Meet quality standards per manufacturer's testing. Integral Color as Davis Colors, Increte, BASF or equal. Davis 8084 or other carbon black pigments are not acceptable.
- C. Dowels – Dowels between pours to be Speed Dowels. 1/2" or 5/8" diameter smooth steel dowels to be used at all construction joints. 18" long smooth steel dowels, placed in the appropriate Speed Dowel sleeve, to be placed at 24" on center.

1.9 CONCRETE FLATWORK

- A. Surface Retarder: Top-Cast surface retarder by Trademark Concrete Systems, Inc., www.trademark.com
 - 1. Apply the top surface retarder at the proper time to achieve the required finish shown on the drawings and per the landscape architect's reference samples.

- B. Curing Compound for Flatwork: Davis Colors W1000 Clear Cure & Seal Color Seal II, tinted to match integrally colored concrete; complying with ASTM C309 and designed for use on integrally colored concrete.
- C. Moist Curing Blankets: McTech Group (www.mctechgroup.com) UltraCure SUN disposable curing blankets designed for use on colored or decorative concrete and to keep surface of concrete moist for seven days.

1.10 ACCESSORIES

- A. Reinforcing Bar Supports: Use corrosion-resistant types at locations contacting exposed surfaces.
- B. Joint Sealants:
 - 1. Provide type specified in Division 07 Section "Joint Sealants".
 - 2. Color: Color selected by Landscape Architect from manufacturer's full range to match integrally colored concrete.
 - 3. Cleaning Agents: Use products known to be compatible with integrally colored concrete.

1.11 CONCRETE FINISHES

- A. Cast in Place Concrete Paving Finishes
 - 1. Finish and Color: Refer to Drawings
- B. Cast in Place Concrete Curbs
 - 1. Finish and Color: Refer to Drawings
- C. Cast in Place Concrete Walls
 - 1. Finish and Color: Refer to Drawings
- D. Cast in Place Concrete Stairs
 - 1. Finish and Color: Refer to Drawings

PART 3 - EXECUTION

3.1 PREPARATION

- A. General contractor to provide proper sub-grade compaction and grading to 0.05'. General contractor to moisture condition the soil and provide sufficient compaction effort using machinery (rolling compactors or large vibratory plate compactors) prior to Concrete Contractor setting forms.
- B. Concrete Contractor shall perform fine grading and form setting. Sawcut control (contraction) joints (1" depth minimum) to be placed at 100SF maximum.

3.2 INSTALLATION

- A. Included by Concrete contractor.
- B. Materials: Top Surface retarder or synthetic (non-muriatic) acid.
- C. Dowels – Place smooth steel dowels, 18" long, at 24" on center at all construction (expansion) joints.
- D. Place concrete.
- E. Apply the top surface retarder at the proper time to achieve the required finish shown on the drawings and per the landscape architect's referee samples.
- F. Install control and expansion joints per the approved shop drawing to minimize cracking.
- G. Clean surface after a seven-day cure or sooner.

- H. Allow the concrete to cure a minimum of 48 hours before placing any protection boards or covering of any kind on the concrete surface. Place non-staining paper (non-asphaltic brown kraft paper) down before covering the concrete with plywood or other type of sheeting material. Do not tape the seams of the paper covering. Cure this mock up for no less than (7) days using the same means and methods that will be used on the actual work.

3.3 INTALLATION TOLERANCES

- A. Uniformly apply the surface retarder evenly at the proper time over the entire concrete area.
- B. Install control joints in a timely manner (no later than 24 hours of placing the concrete) to minimize random cracking.
- C. Clean the concrete after seven days with hot water to remove the surface of any laitance; dispose of wastewater in compliance with all governing regulations.

3.4 MAINTENANCE

- A. Provide a separate price to maintain the project for one year. Cleaning procedure shall capture all wastewater and dispose in accordance with Governmental Regulations.

END OF SECTION

SECTION 32 13 73

CONCRETE PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Expansion and isolation joints within cement concrete pavement.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Compatibility and Adhesion Test Reports: From sealant manufacturer.

1.3 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

1. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 1. Products:
 - a. Crafcro Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
 - c. Or any equivalent product.
- B. Type SL Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
 1. Products:
 - a. Crafcro Inc.; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Or any equivalent product.

2.4 HOT-APPLIED JOINT SEALANTS

- A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.
 1. Products:
 - a. Crafcro Inc.; Superseal 444/777.
 - b. Meadows, W. R., Inc.; Poly-Jet 3406.
 - c. Or any equivalent product.

2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Concrete curing requirement: The concrete must be allowed to cure and dry a minimum of seven days in good drying weather before installing sealant. An additional day of good drying weather must be allowed for each day of poor, inclement weather.
- B. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- C. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.
- D. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- E. Install backer materials to support sealants during application and at position required to produce optimum sealant movement capability. Do not leave gaps between ends of backer materials. Do not stretch, twist, puncture, or tear backer materials. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- F. Install sealants at the same time backings are installed to completely fill recesses provided for each joint configuration and to produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
- H. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 32 13 73

SECTION 32 1400
UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. General: This Section includes Unit Paving in accordance with Contract Documents.
- B. Summary of Work: Provide all labor, equipment and materials required for the procurement, installation and placement of unit paving including subgrade preparation, base, setting bed, and placement procedures as indicated on Drawings and as specified herein.
- C. Related Sections:
 - 1. Division 01 for Special Project Procedures.
 - 2. Specification Section 321314 – Decorative Concrete Finishes
 - 3. Specification Section 328400 – Irrigation

1.2 ACTION SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Samples for unit pavers, joint materials, grout and edge restraints for review and approval of Landscape Architect.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed unit paving work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Mock-Ups: Build a mock-up of each type of unit paving system and each on-grade and on-structure condition. Each mock-up shall demonstrate typical joints, surface color, pattern, texture; and standard of workmanship. Mock up dimensions as follows:
 - 1. Brick Pavers: 20' x 20' containing a mix of all specified colors and representative of a specific plan location to be coordinated with the Landscape Architect.
- C. Lines and Levels: To be established by a licensed Surveyor or registered Civil Engineer.
- D. Pre-Installation Conference: Conduct conference at Project Site.

1.4 PROJECT CONDITIONS

- 1. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Do not appl to substrates with temperatures of 100 deg F (38 deg C) and higher.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

- A. Subject to compliance with project requirements, provide the following:
 - 1. Glen-Gery, Brick Paver Collection, Cityscape Series
 - a. Color and Finish:
 - 1) Liberty Copper
 - 2) Plum Plaza
 - 3) Empire Blue
 - 4) Full Range 2-1
 - b. Size: 4 inches wide by 2-1/4 inches height by 8 inches length.

2.2 ACCESSORIES

- A. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.
- B. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

2.3 AGGREGATE SETTING BED MATERIALS

- A. Sand for Leveling Course: Sound, sharp, washed natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
- B. Sand for Joints: Fine, sharp, washed natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve per ASTM C-144 Grading for Joint Sand.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- B. Cut unit pavers with equipment per Manufacturer recommendations to provide pattern as indicated on Drawings and to fit adjoining work neatly. Use full units without cutting where possible.
- C. Joint Pattern:
 - 1. See Drawings.
 - 2. Match Landscape Architect-approved sample.
- D. Tolerances: Do not exceed 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- E. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths as indicated on Drawings. Provide compressible foam filler as backing for sealant-filled joints. Install joint filler before setting pavers.

3.2 REPAIRS, PROTECTION AND CLEANUP

- A. Remove and replace unit paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Landscape Architect.
- B. Protect unit paving from damage. Exclude traffic from unit paving for at least **21** calendar days after placement. When construction traffic is permitted, maintain unit paving as clean as possible by removing surface stains and spillage of materials as they occur. Treat, repair or replace damaged unit paving as directed by Landscape Architect.
- C. Disposal: Remove from site and legally dispose of surplus construction materials and waste material including excess subsoil, unsuitable soil, forms, trash and debris off of Owner's property.
- D. Maintain unit paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than **2** calendar days before date scheduled for Substantial Completion observations.

END OF SECTION 32 1400

SECTION 32 3113

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Chain link fences and gates as indicated.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 3000 - Cast-in-Place Concrete.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
5. Section 31 2316 - Excavation and Fill for Paving.
6. Section 32 0117 - Pavement Repair.

1.02 SUBMITTALS

- A. Shop Drawings: Submit dimensioned plans and details indicating extent of fences, locations of gates, and details of attachment and footings. Indicate means and methods for surface preparation and finishing.
- B. Certifications: Manufacturers material certifications in compliance with the ASTM standards referenced in this Section.

1.03 REFERENCES

- A. ASTM A392: Standard Specification for Zinc-Coated Steel Chain Link Fence Fabric.
- B. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- C. ASTM A824 - Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain Link Fence.
- D. ASTM F552 - Standard Terminology Relating to Chain Link Fencing.

- E. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- F. ASTM F567: Standard Practice for Installation of Chain Link Fence.
- G. ASTM F626 - Standard Specification for Fence Fittings.
- H. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric.
- I. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
- J. ASTM F934 - Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
- K. ASTM F1083: Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- L. ASTM F1184: Standard Specification for Industrial and Commercial Horizontal Slide Gates.
- M. ASTM F1664 – Standard Specification for Poly Vinyl Chloride (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.
- N. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction.
- O. UL 325 - UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specialized in manufacturing chain link fence products with at least five years of experience.
- B. Fence Installer: Company with demonstrated successful experience installing similar projects and products in accordance with ASTM F567 and with at least five year experience.

PART 2 – PRODUCTS

2.01 CHAIN LINK FABRIC update this with seth info

- A. Galvanized Chain Link Fabric: Conforming to ASTM A392, Class 2 zinc coating, 2.00 ounces minimum per square foot of uncoated wire surface, hot-dipped galvanized after weaving, and with top and bottom edges knuckled (kk). Tie wires and hog rings shall conform to ASTM F626, and shall be 9 gage and galvanized.

B. Chain Link Fabric Requirements:

1. Fabric for perimeter fencing and interior fencing shall be 9 gage woven wire with 1.25 inch anti-climbing mesh, unless otherwise specified.
2. Installed fence fabric shall be free from barbs, icicles, or other projections. Fence fabric with such defects will be deemed defective Work.

2.02 STEEL FENCE FRAMEWORK

- A. Posts, Top Rails, Brace Rails and Gate Frames: Standard weight, galvanized, welded steel pipe conforming to ASTM F1083, Group IA Heavy Industrial Fence Framework, with a minimum yield strength of 30,000 psi. Minimum 1.8 Oz/ft² hot dipped zinc coating average for interior and exterior.
- B. 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
	14'-0" to 16'-0"	4	4.000	9.12	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
Pedestrian 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 to 17'-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

2.03 FITTINGS

- A. Fittings shall be malleable iron conforming to ASTM F626.
- B. Post Caps: Designed to fit snugly over posts with a minimum projection of 1-1/2 inches below top of posts. Post caps shall be manufactured with a curved top.
- C. Eye Tops: Designed to fit over line posts, and for through passage of top rail.
- D. Expansion Sleeve Couplings for Top Rails: Steel, 6 inches long, designed to fit tightly on inside of rail, fitted with raised center.
- E. Rail Ends for Top Rails and Brace Rails: With holes to receive 3/8 inch bolts for securing to rail end bands.
- F. Tension Bands and Bands for Securing Rail Ends: Mild steel flats, at least 11 gage x one inch, tension bands in gates shall be 11 gage by 1 inch. Bolts for use with tension bands and rail end bands shall be galvanized machined 3/8 inch by 1 1/2-inch.
- G. Tension Bars: Mild steel flats at least 3/16 inch by 3/4 inch.

2.04 TENSION WIRE

- A. 6 gage marcelled steel wire conforming to ASTM A824, Type II Class 5 zinc coated, 2.00 ounces minimum per square foot of uncoated wire surface. Wavy type wire is not acceptable.
- B. Turnbuckles for installation with Tension Wires: Eye and hook type, drop forged steel, right and left hand threads, at least 3/8 inch screw diameter with at least 4 1/2-inches of take-up.

2.05 PAINT FOR GALVANIZING REPAIR

- A. Paints for Refurbishing Galvanizing: Organic zinc-rich paint conforming to ASTM A780. Paints used on the site shall be approved by the OWNER.

2.06 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications "Rapid set Cement".

2.07 GATES

- A. General:
 - 1. Gate framework shall be fabricated of tubular steel of sizes indicated on the drawings and conforming to ASTM F1083, Group IA, with a minimum yield

strength of 30,000 psi. Joints at corners shall be miter cut and continuously welded to sides.

2. Install fence fabric to side members with tension bars and tension bands as specified, spaced not more than 14 inches apart. Tension bars shall extend full height of gate. Install fence fabric to top and bottom members and to brace rail with wire ties as specified for top rails, spaced not more than 12 inches apart.
 3. Latches and Hinges: Weld gate latches and strikes to gate posts and frames. Weld provided hinges to posts. Weld 3 hinges on each post for swing gates more than 16 feet wide. Welding shall be performed before gate frames are galvanized, or welds shall be finished as specified below.
 4. Grind welds flush and smooth. Hot-dip galvanize fabricated parts after welding, or be protected by zinc-rich paint in conformance to ASTM A780.
- B. Swing Gates: Galvanized steel welded fabrication in conformance with ASTM F900, fabric size and gage shall match fence. Positive locking gate latch shall be fabricated of 5/16 inch thick by 1 3/4 inch pressed steel galvanized after fabrication.

2.09 CONCRETE

- A. Comply with requirements of Section 03 3000, Cast-in-Place Concrete. Provide normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3,000 psi, 4-inch slump, and one inch maximum size aggregate.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Refer to the following Sections for earthwork related work:
1. Section 31 2200 - Grading.
 2. Section 31 2316 - Excavation and Fill for Paving.
 3. Section 32 0117 - Pavement Repair.

3.02 FRAMEWORK INSTALLATION

- A. Install fences as indicated on Drawings.
- B. Space fence posts at equal intervals between terminal, angle, corner, and gate posts, and not more than 10 feet apart measured from center to center of posts. In curved fence

sections having a radius of 50 feet or less, space posts not more than 5 feet - 6 inches apart. Install posts so that top of eye of post caps are level with top of fabric.

- C. Install angle or corner posts at each change in direction of 15 degrees or more, at change of 5 percent or more in grade of fencing, and at the beginning and end of curved fence sections.
- D. Install terminal posts at ends of runs of fencing. Install gate posts on both sides of driveway and pedestrian gates. For double-leaf gates, net opening between gate posts shall be gate size as indicated on Drawings, plus 3 ½-inches; for single leaf gates, net opening shall be gate size plus 2 ½-inches.
- E. Embed posts into footing 6 inches less than the depth of the footing unless noted otherwise on drawings.
- F. Where a fence is to be installed on a curb, construct footings with top of footing level with the lower finish grade. Align posts, set plumb and true before placing footings. Remove splattered concrete from exposed pipe surfaces while concrete is still soft. In bituminous surfaced areas, install seal coat on top of concrete footings.
- G. Install fences with top rail. Top rail shall pass through eye tops and be secured at ends with rail-end fittings and bands.
- H. Install fences over 10 feet in height, in addition to top rail, with a full length horizontal mid-rail set at mid-height of fence and rigidly secured to posts with rail end fittings and bands.
- I. In fences higher than 10 feet, install brace rails at angles, corners, and terminals at 1/4 and 3/4 of fence height. Provide one horizontal brace rail in panels adjacent to terminal, angle, corner, and gateposts, install at mid-height of fence and rigidly secured to posts with rail end fittings and bands. Provide horizontal brace rails, as specified, in panels of curved sections having a radius of 50 feet or less. Brace rails are not required in fencing 4 feet or less in height.
- J. Provide a transom rail and fabric at top of pedestrian gate openings. Install transom rail 6 feet 8 inches above high point of grade at gate opening. Ends of transom rails shall be pinned or riveted to rail end fittings with 1/4 inch mild steel rivets. Pin or rivet shall go through rail and peen. Welding on rail ends is not permitted.
- K. Install bottom tension wire a minimum of 3 inches from grade for fencing and secure to fence posts with ties. Provide a turnbuckle for each 150 feet of wire or fractional part thereof. Turnbuckles are not required in runs of 15 feet or less. Install ends of tension wires to posts in a manner to prevent slipping or loss of tension. Wrap should start from fence side of post. Turn end of wire around post tightly twisted at least three times around wire. At turnbuckles, wire through eye and tightly twist end at least three times around wire. Cut tail of bottom wire flush.

3.03 CHAIN LINK FABRIC INSTALLATION

- A. Install fence fabric on outward facing side of posts, except for tennis courts. Install fence fabric with top edge projecting above top rail of fence.
- B. Install bottom of fence fabric to clear finish grades, except on bituminous surface install 3/4 inch above such surface. Locally shape and trench ground surfaces where necessary to provide uniform top and bottom alignment of fence.
- C. Tightly stretch fabric and at terminal, pull corner, angle, and gateposts, secure with tension bars extending full height of fence. Secure tension bars to posts with bolted tension bands spaced not more than 14 inches apart.
- D. Bands and Ties: Install bands and ties in accordance with following schedule:

15 bands on 16 feet fence	16 ties on 16 feet fence
11 bands on 12 feet fence	12 ties on 12 feet fence
7 bands on 8 feet fence	7 ties on 8 feet fence
6 bands on 6 feet fence	6 ties on 6 feet fence
4 bands on 4 feet fence	4 ties on 4 feet fence
- E. Fasten fabric to line posts with wire ties spaced not more than 16 inches apart. Where 6 gage aluminum ties are furnished, hook the tie at both ends. Installation of hooked ties with links is not permitted.
- F. Fasten fabric to top rails, mid-rails, brace rails, with wire ties spaced not more than 18 inches apart. Bend back ends of tie wires so as not to be a hazard. At bottom tension wire, install hog rings spaced not more than 18 inches apart. Where 2 fabrics are furnished, lap the fabrics one mesh at mid-rail and tie both fabrics with 9 gage wire or 6 gage aluminum ties to midrails.

3.04 WELD GRINDING

- A. Grind all field welds smooth, clean off flux and spatter, damaged galvanizing removed, burrs and projections ground off, properly prepared, then heavily coated with galvanizing repair coating. Install coating in accordance with written recommendations of manufacturer.

3.05 FIELD AND COURT FENCING

- A. Kickball Field: Chain link fabric for the backstop shall be installed on the field side. Chain link fabric for the backstop hood shall be installed over the framework structure.

3.06 INSTALLATION ON TOP OF CONCRETE WALLS

- A. Posts for fences on top of new concrete or concrete masonry walls shall be installed in 24 gage galvanized iron inserts one inch larger than the outside post diameter. Wall thickness for such installation shall be 8 inches minimum. Depth of embedment of post shall not be less than 15 inches for fence height not exceeding 4 feet. Install post plumb,

true, and fill joint space with non-shrink grout, finished flush with top of wall. Remove excess grout and clean posts.

- B. Do not install footings on existing walls without the review of the ARCHITECT.

3.07 HORIZONTAL APPLICATIONS

3.08 ALTERATIONS TO EXISTING FENCING

A. Resetting Fences:

1. Existing fences shall be reset where finish pavement is raised or lowered more than 6 inches from existing grade. Remove and reinstall entire fence assembly as specified in this Section.
 - a. Where the finish grade is raised 6 inches or less, cut and re-knuckle the existing fence fabric. Adjust tension wire and tie to fabric. Bottom of fence fabric shall be installed $\frac{3}{4}$ " above finish grade.
 - b. Where the finish pavement is lowered 6 inches or less, demolish the fence footing flush with the finish grade and adjust the fabric and its attachments. Bottom of fence fabric shall be installed $\frac{3}{4}$ inches above finish grade.
2. Where existing fencing posts are indicated to be removed, reset or relocated, remove posts including their concrete footings
 - a. Fill footing cavity with sand, compact and cap surface matching existing adjacent material.
 - b. Construct new concrete footings, as specified, in their designated location and set posts as indicated above in Framework Installation Article.
3. Bent posts, rails and accessories shall be replaced with new parts as specified to complete reinstallation. New materials shall closely match design of existing installation. Cut bent portion of posts and weld new sections of equal diameter and thickness. Install splice to inside of all welded section prior to welding. Previously repaired or welded posts shall be replaced.
4. Top rail is required in reinstalled fencing which does not have top rail in its existing condition. Install as specified for new installations.
5. Fabric Removal: Do not remove more than what can be replaced during one day unless a barricade, providing equal security, will be installed in its place. If freestanding temporary fence is used, it shall be clamped and wrap tied.

6. Remove and dispose of off-site concrete debris, chain link, hardware and accessories. Use new hardware and accessories.
7. Gates:
 - a. Remove non-welded type existing hinges and replace with provided weldable hinges. On existing welded hinges remove bolts and replace with new. Remove existing latches and replace with new.
 - b. Weld gate latches and hinges to posts as indicated for new fencing.

3.09 INSTALLATION OF GATES

- A. Provide gates of the sizes indicated on Drawings. Allow clearance on gates of 1-1/2 inches at bottom and one inch at top. Construct gates installed in sloping areas to conform to the grade. Provide an opening in each gate for access to locking device or padlock. Knuckle ends of fabric cut for opening to eliminate hazards.
- B. Sliding Gates and Swing Gates: Fabricate and install as indicated on Drawings. Wheel housing shall be designed to fit tightly to roll track and prevent gate from rolling over objects. Unsupported cantilever type roll gates are not acceptable. Install gate stops in accordance with the drawings. Both top and track stops are required.

3.10 COMPLETION

- A. Completed fencing shall form continuous units between points indicated with required parts, accessories, and fittings provided and installed. Clean exposed metal surfaces of cement, grout and other foreign substances.
- B. Fill in holes left by removal of existing fence footings, except in areas where grading Work is indicated or specified, to existing grade with clean earth thoroughly compacted to at least same density as adjoining soil.

3.11 PROTECTION

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

3.12 CLEANUP

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

END OF SECTION

SECTION 32 3119

ORNAMENTAL FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
 - 1. Steel picket fences and pedestrian gates as indicated on the drawings.
- C. Related Sections:
 - 1. Division 01 – General Requirements.
 - 2. Section 03 2000 – Concrete Reinforcement.
 - 3. Section 03 3000 – Cast-in-Place Concrete.
 - 4. Section 05 0513 – Hot-Dip Galvanizing.
 - 5. Section 31 2319: Excavating and Fill for Structures.
 - 6. Section 32 1313 – Chain Link Fences and Gates.

1.02 REFERENCES

- A. American Galvanizers Association (AGA):
 - 1. Inspection of Products Hot-Dip Galvanized After Fabrication.
 - 2. Quality Assurance Manual.
- B. ASTM International:
 - 1. ASTM A36 – Standard Specification for Carbon Structural Steel.
 - 2. ASTM A-53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3. ASTM A123 – Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

4. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A385 – Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
6. ASTM A500 – Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
7. ASTM A501 – Standard Specification for Hot Formed Welded and Seamless Carbon Steel Structural Tubing.
8. ASTM A513 – Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
9. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
10. ASTM A780 – Standard Practice for of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

C. American Welding Society (AWS):

1. AWS D1.1 – Structural Welding Code - Steel.
2. AWS D-19.0. – Welding Zinc-Coated Steel.

1.03 SUBMITTALS

- A. Shop Drawings: Submit plans and details indicating extent of fences, locations of gates, dimensions and details of attachment and footings.
- B. Product Data: Submit product data for galvanizing repair material indicating compliance to referenced standards.
- C. Hardware Schedule: Submit complete product data of all hardware items to be used, include manufacturer's name, catalog number, relevant dimensions, fasteners, location of item in Work, gate index number, gate dimensions.
- D. Certificates: Manufacturer's Certificates certifying that materials and galvanizing comply with referenced standards.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with a minimum of five years of documented experience.

- B. Installer Qualifications: Company specializing in the installation of the products specified in this Section with a minimum of five years of documented experience.
- C. Welders: Welders shall be AWS certified.
- D. Mockup: Build mockup to set quality standards for fabrication and installation. Mockup shall include a fence panel set between two posts. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 DELIVERY, HANDLING AND STORAGE

- A. Deliver, handle and store fence components to protect galvanized coating from damage during delivery, unloading and installation.
- B. Store components and materials above grade on platforms, skids, or other required supports.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel Members: Size and thickness as indicated on the Drawings.
 - 1. Line Posts, End Posts, and Rails: Carbon steel tubing conforming with ASTM A36, ASTM A53, or ASTM A500.
 - 2. Fence Pickets: In conformance with ASTM A513 or ASTM A36.
 - 3. Plates and Shapes: In conformance with ASTM A36.
 - 4. Perforated Sheet Metal: In conformance with ASTM A653, G90.
- B. Reinforced Concrete:
 - 1. Normal weight complying with requirements in Section 03 3000, Cast-in-Place Concrete. Compressive strength 3,000 PSI minimum at 28 days.
 - 2. Concrete Reinforcement Materials: Per Section 03 2000, Concrete Reinforcement.
- C. Accessibility Signage at Gates: Refer to Section 10 1400, Signage.

2.02 GATE HARDWARE (hardware finish to match adjacent fencing finish)

- A. Hinges: Weld-on hinges by D&D Technologies or equal Brookfield Industries series W.
 - 1. D&D Technologies VersaWeld CI3075 (round posts).

2. D&D Technologies VersaWeld CI3950 (square posts).

B. Latches: Fork latch with padlock.

2.03 FABRICATION

A. General:

1. Fabricate items in shapes and sizes indicated on drawings in as large sections as possible to minimize assembly and field welding at project site.
2. Form all work true to line and level with accurate angles.
3. Exposed work shall be smooth and free of blemishes. Remove blemishes by grinding and/or sanding prior to cleaning, treating and finishing. Ease exposed edges unless otherwise indicated or specified.
4. Form bent metal corners to smallest radius possible without causing grain separation or otherwise damaging Work.
5. Form exposed connections with hairline joints, flush and smooth.
6. Provide vent and drain holes per ASTM A385 for the galvanizing process. Coordinate with the galvanizer for locations and sizes.
7. Remove loose rust, mill scale, cutting, and burrs.

B. Shop Welding:

1. Weld connections as indicated on drawings. Weld corners and seams continuously and in accordance with requirements of AWS D1.1.
2. Exposed welds shall be ground, sanded smooth and flush to match and blend with adjoining surfaces. Remove welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing.

2.04 GALVANIZING AND FINISHING

- A. Hot-Dip galvanize after fabrication in accordance with Section 05 0513 Hot-Dip Galvanizing.
- B. The manufactured galvanized framework shall be powder-coated. The base coat shall be a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2 mils (0.0508mm). The topcoat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be Black. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in the table below.

Table 2 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements

Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 3,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

PART 3 – EXECUTION

3.01 FENCE INSTALLATION

- A. Install fence in accordance with manufacturer's instructions and approved installation drawings.
- B. Drill post footings to depths indicated on the drawings, shore and compact per specification Section 31 2319, Excavating and Fill for Structures.
- C. Place panel posts into drilled holes at locations indicated on drawings; set panels plumb, aligned and at correct height. Stabilize panels into position before pouring concrete footings.
- D. Concrete Footings: Install reinforcement in accordance with Section 03 2000 Concrete Reinforcement. Place concrete around posts per Section 03 3000, Cast-in-Place Concrete and vibrate or tamp for consolidation. Protect fence from concrete splatter. Maintain fence stabilized until concrete is cured.

3.02 FIELD WELDING

- A. Preparation of Weld Area of Galvanized Fabrications: Remove masking from fabrications. Remove remaining zinc coating between one inch and four inches from both sides of members to be welded, by grinding back the zinc coating, burning the zinc away or pushing back the molten zinc from the weld area.
- B. Welding: Welding and welding procedures shall be performed in accordance with American Welding Society D1.1 structural steel code for SMAW, FCAW, GMAW, GTAW processes.
- C. Welding and tacking shall be performed by AWS D1.1 Certified Welders, for the process being utilized in this fabrication, construction. Welders and tackers shall provide current certifications for each welding process to be utilized. Welders shall provide a valid picture Identification before fabrication, welding, installation and during construction.
- D. Welding shall be evaluated per AWS D1.1 weld criterion for appearance, quality, materials and recommendations, methods used in correcting welding work.

1. Welding shall be in accordance with AWS D1.1 Structural Steel Code.
 2. Weld galvanized fabrications in accordance with AWS D-19.0.
- E. Remove welding flux immediately. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surfaces matches those adjacent.
- F. Upon completion of welding plug vent and drainage holes of galvanized fabrications with appropriate diameter zinc plugs. Push in about halfway by hand, and hammer to a tight fit. With a hand file or an abrasive tool, file excess material. Repair damaged surfaces with two coats of Carbomastic 15, by Carboline or equal product approved by OWNER's Office of Environmental Health and Safety (OEHS).
- G. Weld adjoining fence panels as indicated on drawings.
- H. When cutting or drilling of fencing occurs, refinish exposed steel surfaces as follows:
- a. Grind and smooth weld (continuous welds at joint, grind welds flush).
 - b. Clean to SPC-SP2 or SP3.
 - c. Apply zinc-rich repair coating.
 - d. Apply color-matched liquid paint, resulting in a clean, smooth, finish.

3.02 INSTALLATION OF GATES

- A. Gates shall be installed with a 1-1/2-inch clearance at bottom and 1/2" inch clearance at top, between transom panel and gate.
- B. Fabricate and install as indicated on Drawings.
- C. Install accessibility signs as indicated on the drawings.

3.03 COMPLETION

- A. Completed fencing shall form continuous units between points indicated with required parts, accessories, and fittings provided and installed.
- B. Clean exposed metal surfaces of splattered cement, grout and other foreign substances.

3.04 PROTECTION

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

3.05 CLEANUP

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

END OF SECTION

SECTION 32 84 00 - IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

- A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the Owner.
- B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.
- C. Section Includes:
 - 1. Deep Root Watering System
 - 2. In Line Drip Tube
 - 3. Drip Air Relief Valve
 - 4. Drip Operation Indicator
 - 5. Drip Manual Flush Valve
 - 6. Turf Overhead Irrigation
 - 7. Gate Valve
 - 8. Existing Backflow Preventer
 - 9. Existing Irrigation Sub Meter
 - 10. Existing Flow Sensor
 - 11. Existing Master Valve
 - 12. Remote Control Valve
 - 13. Drip Control Zone Kit
 - 14. Existing Smart Irrigation Controller
 - 15. Existing Weather Sensor and Rain Shutoff Combo Device
 - 16. Irrigation Mainline
 - 17. Irrigation Zone Laterals
 - 18. PVC Sleeves
 - 19. Valve Boxes
 - 20. Electrical
 - 21. Irrigation Accessories
 - 22. Sub Surface Irrigation Turf Mat

1.2 CONSTRUCTION DRAWINGS

- A. All offsets, fittings, sleeves, etc. which may be required are not shown on the drawings. The Contractor shall carefully investigate the structural and finished conditions affecting the work and plan the work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
- B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification.
- C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.3 QUALITY ASSURANCE

- A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.
- B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.
- C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.
- D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to Owner.
- E. Secure the required licenses and permits including payments of charges and fees, give required notices to public authorities and verify permits secured or arrangements made by others affecting the work of this section.

1.4 SUBMITTALS

- A. Water Pressure Test
 - 1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the Owner a written verification of the existing water pressure on the project at each of the points of connection shown.
 - 2. The water pressure test shall be performed to measure the dynamic water pressure at the point of connection at the maximum flow rate of the proposed irrigation system as shown on the point of connection note. Dynamic water pressure is when water is flowing through the point of connection. Static water pressure readings when water is not flowing, are not acceptable.
 - 3. Written dynamic water pressure test confirmation shall be made on the contractor's letterhead and include the flow rate during the test, the recorded water pressure, the date of the test and the time of the test.
- B. Material List:
 - 1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the Owner a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.
 - 2. The submittal materials list shall include the following information:
 - a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
 - b. An index sheet showing the item number (e.g. 1,2,3, etc.); an item description (e.g. sprinkler head); the manufacturer's name (e.g. Hunter Industries); the item model number (e.g. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
 - c. The catalog cuts shall be one or two pages copied from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
 - d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.
 - e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.
 - 3. Submittal materials list format requirements:

- a. Submittals shall be provided as one complete package for the project in electronic pdf format. Multiple partial submittals will not be reviewed.
 - b. Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.
 - c. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.
- C. Substitutions: If the Irrigation Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect or Owner's authorized representative for approval.
 - 1. Provide a written statement indicating the reason for making the substitution.
 - 2. Provide catalog cut sheets, technical data, and performance information for each substitute item.
 - 3. Provide in writing the difference in installed price if the item is accepted.
- D. The Landscape Architect or Owner's authorized representative will allow no substitutions without prior written acceptance
- E. No substitutions of pump manufacturers, distributors or assemblies will be accepted.
- F. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
- G. The Landscape Architect or Owner's authorized representative will not review the submittal package unless provided in the format described above.

1.5 EXISTING CONDITIONS

- A. Verify and be familiar with the locations, size and detail of points of connection provided as the source of water, electrical supply connection to the irrigation system.
- B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and Owner's authorized representative prior to beginning construction.
- C. Prior to cutting into the soil, locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground, and take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect and Owner who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.
- D. Protect all existing utilities and features to remain on and adjacent to the project site during construction. Repair, at its own cost, all damage resulting from his operations or negligence.
- E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans prior to paving operations.
- F. Verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.
- G. Protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.
- H. Notify Owner's Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.
- I. Repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made

completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the Owner's Representative.

- J. Provide bore holes under any existing pavement or paving encountered for the required lateral, mainline and low voltage control wire sleeving. Bore holes under 2 inches in diameter and smaller shall be made with a BulletMole® underground boring tool as manufactured by Dimension Tools, LLC (Contact telephone number (888)-650-5554 or at www.bulletmole.com). Bore holes larger than 2 inches in diameter shall be made with an approved mechanical boring tool. No air jacking or hydraulic boring of any kind shall be allowed.

1.6 INSPECTIONS

- A. The Contractor shall permit the Landscape Architect and Owner's authorized representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.
- B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, Owner's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.
- C. Inspections will be required for the following at a minimum:
 - 1. Pre-construction meeting.
 - 2. System layout.
 - 3. Pressure test of irrigation mainline (Four hours at 125 PSI or 120% of static water pressure, whichever is greater.) Mainline pressure loss during test shall not exceed 2 PSI.
 - 4. Coverage test of irrigation system. Test shall be performed prior to any planting.
 - 5. Final inspection prior to start of maintenance period.
 - 6. Final acceptance prior to turnover.
- D. Site observations and testing will not commence without the field record drawings as prepared by the Irrigation Contractor. Record drawings must be complete and up to date for each site visit.
- E. Work that fails testing and is not accepted will be retested. Hourly rates and expenses of the Landscape Architect, Owner's authorized representative, and governing agencies for re-inspection or retesting will be paid by the Irrigation Contractor at no additional expense to Owner.

1.7 STORAGE AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and Owner and at no additional cost to the Owner.
- B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.8 CLEANUP AND DISPOSAL

- A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. Remove and dispose of rubbish and debris at frequent intervals or when ordered to do so by the Owner's authorized representative.
- B. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.9 TURNOVER ITEMS

A. Record Drawings:

1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below.
2. The record drawings shall be prepared to the satisfaction of the Owner. Prior to final inspection of work, submit record drawings to the Landscape Architect or Owner's authorized representative.
3. All record drawings shall be prepared using AutoCAD drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the Landscape Architect or Owner's authorized representative.
4. If the Contractor is unable to provide the AutoCAD drafting necessary for the record drawings the irrigation designer does provide record drawing drafting as a separate service.
5. Show locations and depths of the following items:
 - a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.)
 - b. Routing of sprinkler pressure main lines (dimensions shown at a maximum of 100 feet along routing)
 - c. Isolation valves
 - d. Automatic remote control valves (indicate station number and size)
 - e. Quick coupling valves
 - f. Drip air relief and flush valves
 - g. Routing of control wires where separate from irrigation mainline
 - h. Irrigation controllers (indicate controller number and station count)
 - i. Related equipment (as may be directed)

B. Controller Charts:

1. Existing controller chart to be edited to add new valves. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of six individual colors shall be used for the controller chart unless less than six control valves are indicated.
2. Landscape Architect or Owner's authorized representative must approve record drawings before controller charts are prepared.
3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

C. Operation and Maintenance Manuals:

1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or Owner's authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
2. Each complete, bound manual shall include the following information:
3. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
 - a. Operating and maintenance instructions for all equipment.
 - b. Spare parts lists and related manufacturer information for all equipment.

D. Equipment:

1. Supply as a part of this contract the following items:
 - a. Two quick coupler keys with a 1" bronze hose bib, bent nose type with hand wheel and two coupler lid keys.
 - b. One valve box cover key or wrench.
 - c. For specified ball valves if required: One (1) 5-foot long valve handle, to fit the specified ball valves.
2. The above equipment shall be turned over to Owner's authorized representative at the final inspection.

1.10 COMPLETION

- A. At the time of the pre-maintenance period inspection, the Landscape Architect, Owner's authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by contractor and submitted to Landscape Architect or Owner's authorized representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Landscape Architect, Owner's authorized representative, and governing agencies.
- B. The Owner's authorized representative shall have final authority on all portions of the work.
- C. After the system has been completed, the Contractor shall instruct Owner's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.
- D. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the Owner's satisfaction by the Contractor without any additional expense to the Owner. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

1.11 GUARANTEE

- A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.
- B. Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to Owner within ten (10) calendar days of receipt of written notice from Owner. When the nature of the repairs as determined by the Owner constitute an emergency (i.e. broken pressure line) the Owner may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the Owner by the Contractor, all at no additional cost to the Owner.
- C. Guarantee shall be submitted on Contractors own letterhead as follows:

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within 10 calendar days following written notification by the Owner. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:
PROJECT LOCATION:

CONTRACTOR NAME:
ADDRESS:

TELEPHONE:

SIGNED:

DATE:

PART 2 - MATERIALS/PRODUCTS

2.1 SYSTEMS / ASSEMBLIES / MANUFACTURED UNITS / EQUIPMENT / COMPONENTS / PRODUCT TYPES / MATERIALS

A. Products: Subject to compliance with requirements, Equipment that may be incorporated into the work include, but are not limited to, the following:

1. **Root Zone Watering Kit. Hunter Industries | RZWS-18-CV**
 - a. Description – Bubbler in sleeve with grate. 18" long with check valve at .5 gallons per minute flow rate.
 - b. Operation - Irrigation method for new trees.
2. **Drip Irrigation In Line. Hunter Industries | HDL-06-12-COP**
 - a. Description – Color coded sub surface irrigation drip line with emitters spaced at 12 inches on center with pressure compensation and check valves.
 - b. Operation – Irrigation method for shrub massings.
3. **Drip Irrigation Component – Air Relief Valve. Hunter Industries | AVR-075**
 - a. Description – Device to allow release of air in drip system.
 - b. Operation – Install one per drip zone.
4. **Drip Irrigation Component – Drip Operation Indicator. Hunter Industries | ECO-ID**
 - a. Description – Device to indicate operation of sub surface drip irrigation zones.
 - b. Operation – When drip zone is in operation, yellow stem indicator will extend.
5. **Drip Irrigation Component – Manual Flush Ball Valve. Hunter Industries | PLD-BV**
 - a. Description – Device to flush debris irrigation drip system.
 - b. Operation – Flush each drip zone after installation.
6. **Turf Overhead Irrigation - Rotor and Nozzles. Hunter | I-20-06-PRB w/RedMPR25 Nozzle**
 - a. Description – Pressure regulated 6 inch rotor with match precipitation rate Red MPR25 nozzle..
 - b. Operation – Install per plan and layout to achieve 100% head to head coverage.
7. **Gate Valve. Nibco or Equal | T-111**
 - a. Description – Device to isolate equipment on irrigation mainline.
 - b. Operation – Install per plan.
8. **Existing Backflow Preventer from Package 03. Febco | 825YA with Strong Box Cage**
 - a. Description – Device to prevent contamination of water source.
 - b. Operation – Install per plan in a backflow preventer enclosure. Model per master irrigation legend
9. **Existing Submeter from Package 03. Hunter Industries | HC-200-Flow**
 - a. Description – Sub meter to monitor irrigation water usage.
 - b. Operation – Flow sensor portion of device to be capped and not used.
10. **Existing Flow Sensor from Package 03. Flomec | Flow Sensor QS-200 Size Per Mainline**
 - a. Description – Ultra sonic flow sensor used to detect any anomalies of flow.
 - b. Operation – To be installed with 10 x the diameter of straight pipe incoming end of device and 5 x the diameter of straight pipe outgoing end of device.
11. **Master Valve. Superior | 3300 Series**
 - a. Description – Normally open master valve.
 - b. Operation – Device to shut off system due to any anomalies in flow.

12. **Irrigation Remote Control Valve. Hunter Industries | IBV-FS w/AS-ADJ w/ICD-100 and DEC10 Stake**
 - a. Description – Valve electronically controlled by controller by opening solenoid.
 - b. Operation – To operate all non drip irrigation zones.
13. **Drip Control Zone Kit. Hunter Industries | IBZ-101-LF-40 w/ICD-100 Decoder and DEC10 Stake**
 - a. Description – Factory Pre assembled drip valve kit with pressure regulator and filter.
 - b. Operation – Installed on all drip zones.
14. **Existing Smart Irrigation 2 wire Controller from Package 03. Hunter Industries | A2C-75D-SS w/A2C-D75 Expansion modules and A2C-LAN central control network module. (Quantity Per Master Irrigation Legend)**
 - a. Description – Smart irrigation controller able to utilized on site weather data to save water by making real time adjustments to run times.
 - b. Operation – To operate all valves.
15. **Existing Weather Sensor from Package 03. Hunter Industries | WSS-SEN**
 - a. Wireless on site weather sensor/rain shut off device. Sends real time ET data to controller to assist with adjustment of run times.
 - b. To be installed open to air and free from any obstructions. Also locate in location with most sun during the day.
16. **Pipe**
 - a. Pressure supply line between the water meter and the backflow prevention device shall be type K copper, one size larger than backflow device.
 - b. Backflow prevention assemblies, and all other above grade assemblies, shall be constructed of threaded brass pipe and threaded brass fittings the same size as the backflow device, unless otherwise directed.
 - c. Pressure supply lines minimum size 1 1/4 inches in diameter and smaller downstream of the backflow prevention unit shall be Schedule 40 solvent weld PVC conforming to ASTM D1785. Schedule 80 if in public right of way.
 - d. Pressure supply lines 2 inches in diameter and up to 3 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.
 - e. Pressure supply lines 4 inches in diameter and larger downstream of the backflow unit shall be Class 200 bell and gasket PVC conforming to ASTM 2672.
 - f. Non-pressure lines minimum size 3/4 inch in diameter and larger downstream of the remote control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785. Schedule 80 if in public right of way.
17. **Plastic Pipe and Fittings**
 - a. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.
 - b. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.
 - c. All solvent weld PVC fittings shall be standard weight Schedule 40 (and Schedule 80 where specified on the irrigation detail sheet, all mainline fittings shall be Schedule 80 PVC) and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be

injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.

- d. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.
- e. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.
- f. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.
- g. All pressure mainlines installed with solvent weld PVC fittings shall be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.

18. **Sleeves**

- a. PVC Schedule 40 IPS White Pipe. To be installed for any mainline, lateral, or wires crossing under hardscape per irrigation construction notes and plan. Size to be two times the pipe diameter or wire bundle.

19. **Valve Boxes**

- a. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.
- b. The valve box cover shall be purple in color and secured with a hidden latch mechanism or bolts.
- c. Valve box extensions shall be by the same manufacturer as the valve box.
- d. The plastic irrigation valve box cover shall be an overlapping type.
- e. Automatic control valve, master valve, and flow sensor boxes shall be 17"x11"x12" nominal rectangular size. Valve boxes for drip valve assemblies shall be Jumbo valve boxes size as required to fit assemblies. Valve box covers shall be marked "RCV" with the valve identification number, or "MV", "FS" "heat branded" onto the cover in 1-1/4 inch high letters / numbers.
- f. Quick coupler and ball valve boxes shall be 10" circular size. Valve box covers shall be marked with "QCV" or "BV" "heat branded" onto the cover in 1-1/4 inch high letters.
- g. Valve box shall have brick supports per detail.
- h. Valve box shall have weed barrier and landscape fabric per detail.

20. **Electrical**

- a. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.
- b. All electrical work shall conform to local codes and ordinances.

21. **Low Voltage Wire**

- a. Remote control wire shall be direct-burial AWG-UF type, size as indicated on the drawings, and in no case smaller than 14 gauge.
 - b. Connections shall of the manufacturer, size, and type indicated on the drawings.
 - c. Common wires shall be white in color. Control wires shall be red (where two or more controllers are used, the control wires shall be a different color for each controller. These colors shall be noted on the "Record Drawings" plans located on controller door).
 - d. Ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.
 - e. Flow Sensor Wire shall be shielded.
22. **Irrigation System Accessories** - PVC Glue, Water Proof Wire Splice Kits.
23. **Sub Surface Drip for Turf. Hunter Industries | ECO-MAT-17**
- a. Description – Sub surface drip mat for turf.
 - b. Operation – Installed 3"-4" below grade. Contractor to hand water for supplemental water to establish roots to mat depth.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Root Zone Watering System
 - 1. Two per newly installed tree.
- B. Hunter Drip Line
 - 1. Spacing to be installed per plan.
 - 2. Drip line to be installed 3 inches below grade and stapled at 3 feet on center.
 - 3. Use Hunter – PLD LOC fittings to make all connections.
- C. Drip Air Relief Valve
 - 1. Install in a multi purpose box Hunter – MB-0811 heat branded "AFV" on lid cover.
 - 2. Install at high point of irrigation zone.
 - 3. One per drip zone.
- D. Drip Operation Indicator
 - 1. Install in away from any adjacent hardscape paving.
 - 2. Install in a location visible to maintenance crews.
- E. Drip Manual Flush Valve
 - 1. Install in a multi purpose box Hunter – MB-0811 heat branded "FV" on lid cover.
 - 2. Install at lowest elevation at each drip zone section.
 - 3. One per drip zone section.
- F. Gate Valve
 - 1. Install in a 6 inch round irrigation valve box heat branded "GV" on lid cover.
- G. Remote Control Valve and Drip Control Zone Kit
 - 1. Install in an irrigation valve box heat branded "RCV-XX" where "XX" corresponds to valve station number on controller.
 - 2. All wire connections to use 3M-DBRY waterproof splice kits.

END OF SECTION

SECTION 32 9100
PLANTING SOIL

PART 1 – GENERAL

1.1 SUMMARY

- A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soil and /or the modification of existing site soil for use as Planting Soil, complete as shown on the drawings and as specified herein.
- B. The scope of work in this section includes, but is not limited to, the following:
 - 1. Locate, purchase, deliver and install Imported Planting Soil and soil amendments.
 - 2. Harvest and stockpile existing site soils suitable for Planting Soil.
 - 3. Modify existing stockpiled site soil.
 - a. Modify existing site soil in place for use as Planting Soil.
 - b. Install existing or modified existing soil for use as Planting Soil.
 - 4. Locate, purchase, deliver and install subsurface Drain Lines.
 - 5. Fine grade Planting Soil.
 - 6. Install Compost into Planting Soil.
 - 7. Clean up and disposal of all excess and surplus material.

1.2 CONTRACT DOCUMENTS

- A. Shall consist of specifications, general conditions, and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.3 REFERENCES

- A. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the Specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail.
 - 1. ASTM: American Society of Testing Materials cited section numbers.
 - 2. U.S. Department of Agriculture, Natural Resources Conservation Service, 2003. National Soil Survey Handbook, title 430-VI. Available Online.
 - 3. US Composting Council www.compostingcouncil.org and http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf.
 - 4. *Methods of Soil Analysis*, as published by the Soil Science Society of America (<http://www.soils.org/>).
 - 5. Up by Roots: healthy soils and trees in the built environment. 2008. J. Urban. International Society of Arboriculture, Champaign, IL.

1.4 VERIFICATION

- A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities and shall immediately inform the Landscape Architect of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Landscape Architect.

1.5 PERMITS AND REGULATIONS

- A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Landscape Architect in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.
- B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.
- C. In case of conflict among any referenced standards or codes or among any referenced standards and codes and the specifications, the more restrictive standard shall apply, or Landscape Architect shall determine which shall govern.
- D. Comply with the requirements of the California code of regulation title 23 waters, division 2 department of water resources chapter 2.7 model water efficient landscape ordinance, 492.5 soil management report.
 - 1. Where requirements of specification section Planting Soil are more stringent than the California code, the more stringent requirements shall prevail.

1.6 PROTECTION OF WORK, PROPERTY AND PERSON

- A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to the Contractor's actions.

1.7 CHANGES IN WORK

- A. The Landscape Architect may order changes in the work, and the contract sum adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.
- B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.8 CORRECTION OF WORK

- A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Landscape Architect, at the soonest possible time that can be coordinated with other work and seasonal weather demands but not more than 180 (one hundred and eighty) days after notification.

1.9 DEFINITIONS

- A. Acceptable drainage: Drainage rate is sufficient for the plants to be grown. Not too fast and not too slow. Typical rates for installed Planting Soil are between 1 - 5 inches per hour. Turf soils are often higher, but drainage rates above 2 - 3 inches per hour will dry out very fast. In natural undisturbed soil a much lower drainage rate, as low as 1/8th inch per hour can still support good plant growth. Wetland plants can grow on top of perched water layers or even within seasonal perched water layers, but could become unstable in high wind events.
- B. Amendment: material added to Topsoil to produce Planting Soil Mix. Amendments are classified as general soil amendments, fertilizers, biological, and pH amendments.
- C. Biological Amendment: Amendments such as Mycorrhizal additives, compost tea or other products intended to change the soil biology.
- D. Compacted soil: soil where the density of the soil is greater than the threshold for root limiting, and further defined in this specification.
- E. Compost: well decomposed stable organic material as defined by the US Composting Council and further defined in this specification.

- F. Drainage: The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity. Most often expressed as saturated hydraulic conductivity (Ksat; units are inches per hour).
- G. End of Warranty Acceptance: The date when the Landscape Architect accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation (if applicable) work run concurrent with each other, and further defined in this specification.
- H. Existing Soil: Mineral soil existing at the locations of proposed planting after the majority of the construction within and around the planting site is completed and just prior to the start of work to prepare the planting area for soil modification and/or planting, and further defined in this specification.
- I. Fertilizer: amendment used for the purpose of adjusting soil nutrient composition and balance.
- J. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes other suitable devices, and further defined in this specification, and further defined in this specification.
- K. Finished grade: surface or elevation of Planting Soil after final grading and 12 months of settlement of the soil, and further defined in this specification.
- L. Graded soil: Soil where the A horizon has been stripped and relocated or re-spread; cuts and fills deeper than 12 inches, and further defined in this specification.
- M. Installed soil: Planting soil and existing site soil that is spread and or graded to form a planting soil, and further defined in this specification.
- N. Minor disturbance: Minor grading as part of agricultural work that only adjusts the A horizon soil, minor surface compaction in the top 6 inches of the soil, applications of fertilizers, installation of utility pipes smaller than 18 inches in diameter thru the soil zone.
- O. Landscape Architect: The person or entity, appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Landscape Architect may appoint other persons to review and approve any aspects of the work.
- P. Ped: a clump or clod of soil held together by a combination of clay, organic matter, and fungal hyphae, retaining the original structure of the harvested soil.
- Q. Planting Soil: Topsoil, or Planting Soil Mixes which are imported or existing at the site, or made from components that exist at the site, or are imported to the site; and further defined in this specification.
- R. Poor drainage: Soil drainage that is slower than that to which the plants can adapt. This is a wide range of metrics, but generally if the soil is turning grey in color it is reasonable preferable to either to plant moisture adaptive plants at smaller sizes that are young in age with shallow root balls or look at options to improve the drainage
- S. Punch List: List of work within the Contract, generated by Architect that needs to be completed, repaired, replaced, or rectified by Contractor
- T. Scarify: Loosening and roughening the surface of soil and sub soil prior to adding additional soil on top, and further defined in this specification.
- U. Soil Fracturing: Deep loosening the soil to the depths specified by using a back hoe, and further defined in this specification.
- V. Soil Horizons: as defined in the USDA National Soil Survey Handbook
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242.
- W. Soil Ripping: Loosening the soil by dragging a ripping shank or chisel thru the soil to the depths and spacing specified, and further defined in this specification.
- X. Soil Tilling: Loosening the surface of the soil to the depths specified with a rotary tine tilling machine, roto tiller, (or spade tiller), and further defined in this specification.
- Y. Soil trenching: Cutting narrow trenches thru the soil at the depths and spacing specified to loosen the soil

profile, and further defined in this specification.

- Z. Subgrade: surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.
- AA. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation (if applicable) where the Landscape Architect accepts that all work in these sections is complete, and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project, and further defined in this specification.
- BB. Topsoil: naturally produced and harvested soil from the A horizon or upper layers or the soil as further defined in this specification.
- CC. Undisturbed soil: Soils with the original A horizon intact that have not been graded or compacted. Soils that have been farmed, subjected to fire or logged but not graded, and natural forested land will be considered as undisturbed.

1.10 SUBMITTALS

- A. See the contract General Conditions for policy and procedures related to submittals.
- B. Submit all product submittals eight weeks prior to the start of the soil work.
- C. Product data and certificates: For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with the following:
 - 1. Submit manufacturers or supplier's product data and literature certified analysis for standard products and bulk materials, complying with testing requirements and referenced standards and specific requested testing.
 - a. For each Compost product submit the following analysis by a recognized laboratory:
 - 1.) Ph
 - 2.) Salt concentration (electrical conductivity)
 - 3.) Moisture content %, wet weight basis
 - 4.) Particle size % passing a selected mesh size, dry weight basis
 - 5.) Stability carbon dioxide evolution rate mg CO₂-C per g OM per day
 - 6.) Solvita maturity test
 - 7.) Physical contaminants (inerts) %, dry weight basis
 - 8.) US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels Chemical Contaminants mg/kg (ppm)
 - b. For Coarse Sand product submit the following analysis by a recognized laboratory:
 - a.) pH
 - b.) Particle size distribution (percent passing the following sieve sizes):
 - 3/8 inch (9.5 mm)
 - No 4 (4.75 mm)
 - No 8 (2.36 mm)
 - No 16 (1.18 mm)
 - No 30 (.60 mm)
 - No 50 (.30 mm)
 - No 100 (.15 mm)
 - No 200 (.075 mm)
- D. Samples: Submit samples of each product and material, where required by Part 2 of the specification, to the Landscape Architect for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only.

1. Submit samples a minimum of 8 weeks prior to the anticipated date of the start of soil installation.
 2. Samples of all Topsoil, Coarse Sand, Compost and Planting Soil shall be submitted at the same time as the particle size and physical analysis of that material.
- E. Soil testing for Imported and Existing Topsoil, existing site soil to be modified as Planting Soil and Planting Soil Mixes.
1. Topsoil, existing site soil and Planting Soil Mix testing: Submit soil test analysis report for each sample of Topsoil, existing site soil and Planting Soil from an approved soil-testing laboratory and where indicated in Part 2 of the specification as follows:
 - a. Submit Topsoil, Planting Soil, Compost, and Coarse Sand for testing at least 8 weeks before scheduled installation of Planting Soil Mixes. Submit Planting Soil Mix test no more than 2 weeks after the approval of the Topsoil, Compost and Coarse Sand. Do not submit to the testing laboratory, Planting Soil Mixes, for testing until all Topsoil, Compost and Coarse Sand have been approved.
 - b. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by the Landscape Architect.
 - c. All soil testing will be at the expense of the Contractor.
 - d. Submit a copy of the Planting Plan and Plant Legend to the laboratory with the samples. Soil test of fertility, agricultural suitability, and appraisal by the following (or approved equal, see Quality Assurance section):
 - 1.) Wallace Laboratories (310) 615-0116, info@wllabs.com, wllabs.com.
 2. Submit all testing required by California Code of regulation Title 23 waters, Division 2 Department of Water resources Chapter 2.7 Model Water Efficient Landscape Ordinance, 492.5 Soil Management Report.
 3. Provide a particle size analysis (% dry weight) and USDA soil texture analysis. Soil testing of Planting Soil Mixes shall also include USDA gradation (percentage) of gravel, coarse sand, medium sand, and fine sand in addition to silt and clay.
 4. Provide the following other soil properties:
 - a. pH and buffer pH.
 - b. Percent organic content by oven dried weight.
 - c. Nutrient levels by parts per million including: boron, copper, molybdenum, sodium, sulfur, phosphorus, potassium, magnesium, manganese, iron, zinc and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings specified.
 - d. Soluble salt by electrical conductivity of a 1:2 soil water sample measured in Milliohm per cm.
 - e. Cation Exchange Capacity (CEC).
 - f. Bulk Density
 - 1.) Dry Weight Basis (pounds per cubic foot)
 - 2.) At max. water holding capacity (pounds per cubic foot)

1.11 OBSERVATION OF THE WORK

- A. The Landscape Architect may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.
 1. The Landscape Architect may utilize the Contractor's penetrometer and moisture meter at any time to check soil compaction and moisture.
- B. The Landscape Architect shall be informed of the progress of the work so the work may be observed at the

following key times in the construction process. The Landscape Architect shall be afforded sufficient time to schedule visit to the site if necessary. Failure of the Landscape Architect to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.

1. COMPLETION OF FINE GRADING AND SURFACE SOIL MODIFICATIONS REVIEW: Upon completion of all surface soil modifications and fine grading but prior to the installation of shrubs, ground covers, or lawns.

1.12 QUALITY ASSURANCE

- A. Installer Qualifications: The installer shall be a firm having at least 5 years of experience of a scope similar to that required for the work, including the preparation, mixing and installation of soil mixes to support planting. The installer of the work in Section: Planting, shall be the same firm installing the work in this section.
 1. The bidders list for work under this section shall be approved by the Landscape Architect.
 2. Installer Field Supervision: When any Planting Soil work is in progress, installer shall maintain, on site, an experienced full-time supervisor who can communicate in English with the Landscape Architect.
 3. Installer's field supervisor shall have a minimum of five year's experience as a field supervisor installing soil, shall be trained and proficient in the use of field surveying equipment to establish grades and can communicate in English with the Landscape Architect.
 4. The installer's crew shall be experienced in the installation of Planting Soil, plantings, and irrigation (where applicable) and interpretation of planting plans, soil installation plans, and irrigation plans (where applicable).
 5. Submit references of past projects and employee training certifications that support that the Contractors meet all of the above installer qualifications and applicable licensures.
- B. Soil testing laboratory qualifications: an independent laboratory, with the experience and capability to conduct the testing indicated and that specializes in USDA agricultural soil testing, Planting Soil Mixes, and the types of tests to be performed. Geotechnical engineering testing labs shall not be used.
- C. All delivered and installed Planting Soil shall conform to the approved submittals sample color, texture and approved test analysis.
 1. The Landscape Architect may request samples of the delivered or installed soil be tested for analysis to confirm the Planting Soil conforms to the approved material.
 2. All testing shall be performed by the same soil lab that performed the original Planting Soil testing.
 3. Testing results shall be within 10% plus or minus of the values measured in the approved Planting Soil Mixes.
 4. Any Planting Soil that fails to meet the above criteria, if requested by the Landscape Architect, shall be removed and new soil installed.
- D. Soil compaction testing: following installation or modification of soil, test soil compaction with a penetrometer.
 1. Maintain at the site at all times a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture.
 - a. Penetrometer shall be AgraTronix Soil Compaction Meter distributed by Ben Meadows, www.benmeadows.com or approved equal.
 - b. Moisture meter shall be "general digital soil moisture meter" distributed by Ben Meadows, www.benmeadows.com or approved equal.
 2. Prior to testing the soil with the penetrometer check the soil moisture and penetrometer readings in the mockup soils. Penetrometer readings are impacted by soil moisture and excessively wet or dry soils will read significantly lower or higher than soils at optimum moisture.
 3. The penetrometer readings shall be within 20% plus or minus of the readings in the approved mockup when at similar moisture levels.

1.13 SITE CONDITIONS

- A. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify the Landscape Architect, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
 - 1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Landscape Architect in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Landscape Architect of such conditions, they shall remain responsible for plant material under the warrantee clause of the specifications.
 - 2. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.

1.14 SOIL COMPACTION – GENERAL REQUIREMENTS

- a. Except where more stringent requirements are defined in this specification. The following parameters shall define the general description of the threshold points of soil compaction in existing, modified or installed soil and subsoil.
- B. The following are threshold levels of compaction as determined by each method.
 - 1. Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.
 - a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
 - b. Standard Proctor Method – 75-85%; soil below 75% is unstable and will settle excessively.
 - c. Penetration Resistance Method – about 75-250 psi, below 75 psi soil becomes increasingly unstable and will settle excessively.
 - 2. Root limiting Compaction: Root growth is limited with fewer, shorter and slower growing roots.
 - a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
 - b. Standard Proctor Method – above approximately 85%.
 - c. Penetration Resistance Method – about 300 psi.
 - 3. Excessive Compaction: Roots not likely to grow but can penetrate soil when soil is above field capacity.
 - a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
 - b. Standard Proctor Method – Above 90%.
 - c. Penetration Resistance Method – Approximately above 400 psi

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity.
- B. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Cover stockpiles with plastic sheeting or fabric at the end of each workday.
- C. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. Biological additives shall be protected from extreme cold and heat. All products shall be freshly manufactured and dated for the year in which the products are to be used.
- D. Deliver all chemical amendments in original, unopened containers with original labels intact and legible, which state the guaranteed chemical analysis. Store all chemicals in a weather protected enclosure.
- E. Bulk material: Coordinate delivery and storage with Landscape Architect and confine materials to neat piles in

areas acceptable to Landscape Architect.

1.16 EXCAVATING AND GRADING AROUND UTILITIES

- A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. Determine location of underground utilities and perform work in a manner that will avoid damage. Hand excavation as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Notification of DigAlert, #811 is required for all planting areas. The Contractor is responsible for knowing the location and avoiding utilities that are not covered by DigAlert.

PART 2 – PRODUCTS

2.1 IMPORTED TOPSOIL

- A. Imported Topsoil definition: Fertile, friable soil containing less than 5% total volume of the combination of subsoil, refuse, roots larger than 1 inch diameter, heavy, sticky or stiff clay, stones larger than 2 inches in diameter, noxious seeds, sticks, brush, litter, or any substances deleterious to plant growth. It shall also be free from wire, plaster, construction debris, or similar objects that would be a hindrance to planting or maintenance. The percent (%) of the above objects shall be controlled by source selection not by screening the soil. Topsoil shall be suitable for the germination of seeds and the support of vegetative growth. Imported Topsoil shall not contain weed seeds in quantities that cause noticeable weed infestations in the final planting beds. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens. Imported Topsoil shall meet the following physical and chemical criteria:
 - 1. Soil texture: USDA loam, sandy clay loam or sandy loam with clay content between 15 and 25%. And a combined clay/silt content of no more than 50%.
 - a. Particle Size and Composition
 - 1.) Coarse Sand (0.5 to 2.0mm), up to 15%
 - 2.) Silt plus clay (<0.05mm), 15% to 50%
 - 3.) Other Classes
 - a.) Gravel (2 to 13mm), up to 15%
 - b.) Rock (1/2-inch to 1 inch), up to 5%
 - c.) Rock (greater than 1 inch), not allowed, 0%
 - 2. pH value shall be between 5.5 and 7.8 without high lime content.
 - 3. Percent organic matter (OM): 2.0-5.0%, by dry weight.
 - 4. Soluble salt level: Less than 2 mmho/cm.
 - 5. Soil chemistry suitable for growing the plants specified.
 - a. Salinity: Saturation Extract Conductivity (ECe) - less than 3.0 sD/m @ 25° C
 - b. Sodium: Sodium Absorption Ratio (SAR) - less than 6.0
 - c. Boron: Saturation Extract Concentration - Less than 1.0 ppm
 - d. Soil shall contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required material prior to planting.
- B. Imported Topsoil shall be a harvested soil from fields or development sites. The organic content and particle size distribution shall be the result of natural soil formation. Manufactured soils where Coarse Sand, composted organic material or chemical additives has been added to the soil to meet the requirements of this specification section shall not be acceptable. Retained soil peds shall be the same color on the inside as is

visible on the outside.

- C. Imported Topsoil for Planting Soil shall NOT have been screened and shall retain soil peds or clods larger than 2 inches in diameter throughout the stockpile after harvesting.
- D. Stockpiled Existing Topsoil at the site meeting the above criteria may be acceptable.
- E. Provide a two-gallon sample from each Imported Topsoil source with required soil testing results. The sample shall be a mixture of the random samples taken around the source stockpile or field. The soil sample shall be delivered with soil peds intact that represent the size and quantity of expected peds in the final delivered soil.

2.2 GROWING MEDIA

- A. 80/20 Custom Topsoil mix by Earthworks Soil Amendments, Inc. (951)782-0260
- B. Planter Pot Soil: Soil placed in planter pots (for example, fiberglass or clay pottery).
 - 1. "SUCCESSOIL", produced by Green House Nurseries, Inc. (818) 899-0977.
 - a. Blend of Canadian Peat, volcanic rock, cypress shavings, composted pine bark and coarse builder's sand, with slow release Nutricote fertilizer.
 - b. Soil shall have the following characteristics:
 - 1.) Low compaction rate.
 - 2.) Good bulk density.
 - 3.) Natural capillary action for sub-irrigation.
- C. In order to ensure conformance, samples of the import soil shall be submitted to an approved laboratory for analysis prior to and following backfilling.

2.3 COMPOST

- A. Compost: Blended and ground leaf, wood and other plant-based material, composted for a minimum of 9 months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material at levels that are harmful to plants or humans. Source material shall be yard waste trimmings blended with other plant or manure-based material designed to produce Compost high in fungal material.
 - 1. Compost shall be commercially prepared Compost and meet US Compost Council STA/TMECC criteria or as modified in this section for "Compost as a Landscape Backfill Mix Component".
http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf
 - 2. High Value Compost shall comply with the following parameters:
 - a. Composted aerobic humus compost without presence of decomposition products. The organic matter content shall be at least 50% on a dry weight basis. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%.
 - b. The pH of the material shall be between 6 and 7.5.
 - c. The salt content shall be less than 6 millimho/cm @ 25° C. (ECe less than 6) in a saturated paste extract.
 - d. Boron content of the saturated extract shall be less than 1.0 part per million.
 - e. Silicon content (acid-insoluble ash) shall be less than 50%.
 - f. Calcium carbonate shall not be present if to be applied on alkaline soils.
 - g. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
 - h. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based

products are not acceptable which are based on red wood or cedar.

- i. Sludge-based materials are not acceptable.
 - j. Carbon:nitrogen ratio is between 8.0 and 20:1.
 - k. SAR (sodium adsorption ratio) less than 5.
 - l. Seed germination - over 80% germination in saturation extract diluted 1 to 3 in water compared to seeds germinated in deionized water.
 - m. Germination vigor - equal to or better than seed length for seeds germinated in deionized water.
 - n. Maturity and stability – Solvita 5 or higher.
 - o. Molar ratio of ammoniacal nitrogen to nitrate nitrogen less than 2.
 - p. The compost shall be aerobic without malodorous presence of decomposition products.
 - q. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen.
3. Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:
- a. arsenic 12
 - b. cadmium 15
 - c. chromium 100
 - d. cobalt 50
 - e. copper 100
 - f. lead 100
 - g. mercury 10
 - h. molybdenum 20
 - i. nickel 100
 - j. selenium 20
 - k. silver 10
 - l. vanadium 50
 - m. zinc 200
4. Regular Compost shall comply with the following parameters:
- a. Humus material shall have an acid-soluble ash content of no less than 5% and no more than 20%. Organic matter shall be at least 50% on a dry weight basis.
 - b. The pH of the material shall be between 6 and 7.8.
 - c. The salt content shall be less than 10 millimho/cm @ 25° C. in a saturated paste extract.
 - d. Boron content of the saturated extract shall be less than 1.0 parts per million.
 - e. Silicon content (acid-insoluble ash) shall be less than 50%.
 - f. Organic matter shall be at least 50% on a dry weight basis.
 - g. Calcium carbonate shall not be present if to be applied on alkaline soils.
 - h. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
 - i. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based

products are not acceptable which are based on red wood or cedar.

- j. Sludge-based materials are not acceptable.
 - k. Carbon:nitrogen ratio is less than 25:1.
 - l. The compost shall be aerobic without malodorous presence of decomposition products.
 - m. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen for soil amending. The maximum particle size shall be 0.25 inch for hydroseeding.
5. Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:
- a. arsenic 12
 - b. cadmium 15
 - c. chromium 200
 - d. cobalt 50
 - e. copper 150
 - f. lead 200
 - g. mercury 10
 - h. molybdenum 20
 - i. nickel 100
 - j. selenium 30
 - k. silver 5
 - l. vanadium 50
 - m. zinc 250
 - n. Higher amounts of salinity or boron may be present if the soils are to be preleached to reduce the excess or if the plant species will tolerate the salinity and/or boron.
6. Provide a two gallon sample with manufacturer's literature and material certification that the product meets the requirements.

2.4 COARSE SAND

A. Clean, washed, sand, free of toxic materials

- 1. Coarse concrete sand, ASTM C-33 Fine Aggregate, with a Fines Modulus Index of 2.8 and 3.2.
- 2. Coarse Sands shall be clean, sharp, natural Coarse Sands free of limestone, shale and slate particles. Manufactured Coarse Sand shall not be permitted.
- 3. pH shall be lower than 7.0.
- 4. Provide Coarse Sand with the following particle size distribution:

<u>Sieve</u>	<u>Percent passing</u>
3/8 inch (9.5 mm)	100
No 4 (4.75 mm)	95-100
No 8 (2.36 mm)	80-100
No 16 (1.18 mm)	50-85
No 30 (.60 mm)	25-60
No 50 (.30 mm)	10-30
No 100 (.15 mm)	2-10
No 200 (0.75 mm)	2-5

- B. Provide a two gallon sample with manufacturer's literature and material certification that the product meets

the requirements.

- C. Medium Coarse Sand shall be used as a backfill material for Palm Trees. Refer to the Section 32 93 00 – Planting.

2.5 FERTILIZER, BIOLOGICAL and other AMENDMENTS

- A. Contractor shall provide amendments recommended by Soils Report at no additional cost to Owner, including recommendations for the quality of organic amendment.
- B. Mycorrhizal fungi shall be added in all planting areas, regardless of Soils Report.
 - 1. Mycorrhizal inoculum consists of a combination of :
 - a. Blend of eight top types of Endospores: Glomus aggregatum, G. clarum, G. deserticola, G. intraradices, G. monosporus, G. mosseae, Gigaspora margarita, and Paraglomus brasilianum,
 - b. Blend of seven top types of Ecto fungi spores: Lacarria laccata, Pisolithus tinctorius, Rhizopogon amylopogon, R. fulvigleba, R. rubescens, R. villosuli, and Scleroderma spp.
 - c. The guaranteed Endo spore count shall be a minimum 50 spores/cc,
 - d. The Ecto spore count shall be a minimum 50,000 spores/cc
 - 2. Manufacturers:
 - a. BioOrganics Mycorrhizae Inoculants, (888) 332-7676
 - b. Mycorrhizal Applications, Inc, (866) 476-7800
 - c. Fox Farm, (800) 436-9327
 - d. Or approved equal.

2.6 LIME

- A. ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.
 - 2. Provide lime in form of dolomitic limestone.
- B. Provide manufacturer's literature and material certification that the product meets the requirements.

2.7 EXISTING SOIL (Site Soil Acceptable for planting with minimum modifications)

- A. General definition of existing soil: Surface soil in the areas with existing soil, that is not altered, compacted to root limiting density, graded or contaminated before or during the construction process and considered acceptable for planting and long-term health of the plants specified either as it exists or with only minor modification.
 - 1. The Landscape Architect shall verify that the soil in the designated areas is suitable at the beginning of planting bed preparation work in that area. In the event that the work of this project construction has damaged the existing soil in areas designated for use as Planting Soil to the point where the soil is no longer suitable to support the plants specified, the Landscape Architect may require modification of the damaged soil up to and including removal and replacement with soil of equal quality to the soil that existed prior to construction. Examples of damage include further compaction, contamination, grading, creation of hard pan or drainage problems, and loss of the O, and or A horizon.
- B. Protect existing soil from compaction, contamination, and degradation during the construction process.
- C. Unless otherwise instructed, remove all existing plants, root thatch, and non-soil debris from the surface of the soil using equipment that does not increase compaction of soil to root limiting levels.

D. Modifications:

1. When results of soil tests recommend chemical adjustments, till surface soil to six inches or greater after chemical adjustments have been applied.
2. Remove existing turf thatch, ground cover plants and weeds.
3. Provide pre-emergent weed control if indicated.
4. Make chemical adjustment as recommended by the soil test.

2.8 Modified Existing Soil (SITE SOIL Suitable for planting with indicated modification)

A. General definition: Surface soil in the areas submitted to the Landscape Architect as Modified Existing Soil has been altered and or graded before or during the construction process but is still considered acceptable for planting and long-term health of the plants specified with the proposed modifications. Modifications respond to the soil problems expected or encountered. The Landscape Architect shall verify that the soil in the designated areas is suitable for modification at the beginning of planting bed preparation work in that area.

1. The Landscape Architect shall verify that the soil in the designated areas is suitable for the specified modification at the beginning of planting bed preparation work in that area. In the event that the work of this project construction has damaged the existing soil in areas designated for modification to the point where the soil is no longer suitable to support the plants specified with the specified modification, the Landscape Architect may require further modification of the damaged soil up to an including removal and replacement with soil of equal quality to the soil that would have resulted from the modification. Damage may include further compaction, contamination, grading, creation of hard pan or drainage problem, and loss of the O, and or A horizon.
2. General requirements for all soil modifications:
 - a. Take soil samples, test for chemical properties, and make appropriate adjustments.
 - b. Unless otherwise instructed, remove all existing plants, root thatch, and non-soil debris from the surface of the soil using equipment that does not add to the compaction in the soil.
 - c. All soil grading, tilling and loosening must be completed at times when the soil moisture is below field capacity. Allow soil to drain for at least two days after any rain event more than 1 inch in 24 hours, or long enough so that the soil does not make the hand muddy when squeezed.
 - d. Provide pre-emergent weed control after the soil work is complete and plants planted but prior to adding mulch to the surface, if indicated by weed type and degree of threat.

B. Modified existing soil – soil removed, stockpiled, and spread

1. Modifications:

- a. Excavate existing soil from the areas and to depths designated on the drawings. Stockpile in zones noted on the drawings or in areas proposed by the Contractor.
 - 1.) Prepare a soil stockpile plan for approval.
- b. Excavate soil using equipment and methods to preserve the clumps and peds in the soil. Generally, this means using the largest piece of equipment that is practical for the project size and scope.
- c. Protect stockpiles from erosion by compacting or tracking the soil surface, covering with breathable fabric or planting with annual grasses as appropriate for the season, location, and length of expected time of storage.
- d. Re-spread soil as required in Part 3 of this specification.

C. Modified existing soil – compacted surface soil (Tilling Option).

1. Description of condition to be modified: Surface soil compaction to a maximum of 6 inches deep from traffic or light grading. Original A horizon may be previously removed or graded but lower profile intact with acceptable compaction levels and limited grading. The soil organic matter, pH and chemistry in the A

horizon may not be suitable for the proposed plants and may need to be modified as required.

2. Modifications:

- a. Till top 6 inches or deeper of the soil surface, with a roto tiller, spade tiller, ripper or agricultural plow. Spread 2 - 3 inches of Compost on the surface of the tilled soil and make any chemical adjustment as recommended by the soil test.
- b. Till or disk the Compost into the loosened soil. Smooth out grades with a drag rake or drag slip.

D. Modified existing soil – compacted surface soil (Radial Trenching Option)

1. Description of condition to be modified: Surface soil compaction to a maximum of 24 inches deep from traffic or light grading. Original A horizon may be previously removed or graded but lower profile below 24 inches intact with acceptable compaction levels and limited grading. The soil organic matter, pH and chemistry in the A horizon may not be suitable for the proposed plants and may need to be modified as required.
2. Modifications:
 - a. Using a trenching machine, dig trenches to the extent and depth shown on the plans and details.
 - b. Backfill the trench with the soil removed from the trench. Add additional site soil if needed to fill the trench to be flush to the existing grade after the soil settlement.

E. Modified existing soil – compacted subsoil

1. Deep soil compaction the result of previous grading, filling and dynamic or static compaction forces. Original A horizon likely removed or buried. The soil organic matter, pH and chemistry in the A horizon is likely not suitable for the proposed plants and should be modified as required.
2. Soil Ripping:
 - a. Step one: After grading and removing all plants and debris from the surface, using a tracked dozer or similar large grading equipment, loosen the soil by dragging a ripping shank or chisel thru the soil to depths of 24 inches with ripping shanks spaced 18 inches or less apart in two directions. The number of shanks per pull is dependent on the degree of soil compaction and the size of the dozer.
 - b. Step 2: Spread 3-4 inches of Compost over the ripped area and till into the top 6 inches of the soil surface.
3. Soil Fracturing:
 - a. Step one: After grading and removing all plants and debris from the surface, spread 2 – 3 inches of Compost over the surface of the soil. Loosen the soil to depth of 18 - 24 inches, using a backhoe to dig into the soil through the Compost. Lift and then drop the loosened soil immediately back into the hole. The bucket then moves to the adjacent soil and repeats the process until the entire area indicated has been loosened.
 - b. Step 2: Spread 3-4 inches of Compost over the ripped area and till into the top 6 inches of the soil surface.
4. Trenching:
 - a. Step one: After grading and removing all plants and debris from the surface using a chain trenching machine, dig 24 inch deep trenches, 24 inches apart across the entire area. Maintain an 18-inch standoff from the edges of all curbs, paving and structures. Backfill the trenches with Compost.
 - b. Step 2: Spread 3-4 inches of Compost over the trenches area and till into the top 6 inches of the soil surface. Compost tilling treatment shall extend to the edges of curbs, paving and structures.
5. Following soil ripping or fracturing the average penetration resistance should be less than 250 psi to the depth of the ripping or fracturing.
6. Do not start planting into ripped or fractured soil until soil has been settled or leave grades sufficiently high to anticipate settlement of 10 – 15% of ripped soil depth.

F. Modified existing soil – low organic matter

1. Description of condition to be modified: Low soil organic matter and/or missing A horizon but soil is not compacted except for some minor surface compaction. The soil organic matter, pH and/or chemistry are likely not suitable for the proposed plants and should be modified as required.
2. Modifications:
 - a. Spread 3 - 4 inches of Compost over the surface of the soil and make chemical adjustment as recommended by the soil test.
 - b. Till Compost into the top 6 inches of the soil.

G. Modified existing soil – soil within the root zone of existing established trees

1. Description of condition to be modified: Surface compaction near or above root limited levels in the upper soil horizon the result of traffic or other mechanical compaction.
2. Modifications:
 - a. Remove the tops of all plants to be removed from the root zone. Remove sod with a walk behind sod cutter. Do not grub out the roots of plants to be removed.
 - b. Use a pneumatic air knife to loosen the top 9 – 12 inches of the soil. Surface roots may move and separate from soil during this process but the bark on roots should not be broken
 - 1.) Pneumatic air knife shall be as manufactured by:
Concept Engineering Group, Inc., Verona, PA (412) 826-8800
or
Supersonic Air Knife, Inc., Allison Park, PA (866) 328 5723
 - c. Make chemical adjustment as recommended by the soil test and add 2 - 3 inches of Compost over the soil.
 - d. Using the pneumatic air knife, mix the Compost into the top 6 – 8 inches of the loosened soil.
 - e. Work in sections such that the entire process - including irrigation - can be completed in one day. Apply approximately one inch of water over the loosened soil at the completion of each day's work. Apply mulch or turf as indicated on the drawings within one week of the completion of work.

H. Modified existing soil – soil within tree pits

1. Perform percolation tests in tree pits prior to bringing trees to site.
2. Once holes have been dug per the contract drawings, fill sand pit with water to a depth of twelve inches and report the time required for all water to drain from hole.
 - a. If drainage requires more than 24 hours, contractor shall install, at no additional cost to owner, a six-inch diameter perforated PVC chimney drain, a minimum forty-eight inches deep, gravel filled, covered with geotextile, set vertically at the lowest point of the bottom of the tree pit with a minimum two percent slope away from the tree.

2.9 Planting soil Mixes

- A. General definition: Mixes of Existing Soil or Imported Topsoil, Coarse Sand, and or Compost to make a new soil that meets the project goals for the indicated planting area. These may be mixed off site or onsite and will vary in Mix components and proportions as indicated.
- B. Planting Mix - moderately slow draining soil for trees and shrub beds
 1. A Mix of Imported Topsoil, Coarse Sand and Compost. The approximate Mix ratio shall be:

Mix component	% by moist volume
Imported Topsoil unscreened	45-50%
Coarse sand	40-45%

Compost 10%

2. Final tested organic matter between 2.75 and 4% (by dry weight).
3. Mix the Coarse Sand and Compost together first and then add to the Topsoil. Mix with a loader bucket to loosely incorporate the Topsoil into the Coarse Sand/Compost Mix. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil. Clumps of Soil, Compost and Coarse Sand will be permitted in the overall Mix.
4. At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.
5. Provide a two-gallon sample with testing data that includes recommendations for chemical additives for the types of plants to be grown. Samples and testing data shall be submitted at the same time.

2.10 Heavy duty pipe Drain Pipe

- A. Drain pipe shall be 4 inch diameter, perforated, PVC, Schedule 40 pipe. Holes in the pipe shall only be on the bottom quadrant. All fittings, elbows, unions, T's and screw caps shall be the same material and from the same manufacturer as the pipe. "T" and elbow joints shall be sanitary type connections. All joints shall be solvent welded. Submit manufacturers product literature for approval by the Landscape Architect.
 1. When pipe has perforations on all quadrants, drape a 12 inch wide 4 mil plastic sheet over the length of the pipe to force water to the bottom of the pipe.
- B. Clean out: Clean out risers shall be 4 inch diameter Schedule 40 PVC solid pipe compatible with the bottom fitting and clean out screw cap. Elbow fitting at the bottom of the clean out riser. When the cleanout is in the middle of a pipe run the fitting shall be a sanitary T fitting. Screw cap FITTING shall be PVC Schedule 40.

2.11 Medium duty pipe Drain Pipe

- A. Drain pipe shall be 4 inch diameter, perforated, PVC, double wall (smooth interior wall / corrugated exterior wall) pipe. Holes in the pipe shall only be on the bottom quadrant. All fittings, elbows, unions, T's and screw caps shall be the same material and from the same manufacturer as the pipe. "T" and elbow joints shall be sanitary type connections. All joints shall be gasketed bell and spigot. Example source A -2000 by Contech Construction Products or approved equal. Submit manufacturers product literature for approval by the Landscape Architect.
 1. When pipe has perforations on all quadrants, drape a 12 inch wide 4 mil plastic sheet over the length of the pipe to force water to the bottom of the pipe.
- B. Clean out: Clean out risers shall be 4 inch diameter Schedule 40 PVC solid pipe compatible with the bottom fitting and clean out screw cap. Elbow fitting at the bottom of the clean out riser. When the cleanout is in the middle of a pipe run the fitting shall be a sanitary T fitting. Screw cap FITTING shall be PVC Schedule 40.

2.12 Light duty pipe Drain Pipe

- A. A. Drain pipe shall be 4 inch diameter, perforated, HDPE, single wall corrugated exterior pipe. ASTM F405. All fittings, elbows, unions, T's and screw caps shall be the same material and from the same manufacturer as the pipe. All joints shall be gasketed bell and spigot. Example source ADS Single Wall Pipe by Advance Drainage Systems or approved equal. Submit manufacturers product literature for approval by the Landscape Architect.
 1. When pipe has perforations on all quadrants, drape a 12 inch wide 4 mil plastic sheet over the length of the pipe to force water to the bottom of the pipe.
- B. Clean out: Clean out risers shall be 4 inch diameter Schedule 40 PVC solid pipe compatible with the bottom fitting and clean out screw cap. Elbow fitting at the bottom of the clean out riser. When the cleanout is in the middle of a pipe run the fitting shall be a sanitary T fitting. Screw cap FITTING shall be PVC Schedule 40.

PART 3 – EXECUTION

3.1 SITE EXAMINATION

PARADISE CANYON ELEMENTARY SCHOOL
PACKAGE 5 – NEW NORTH BUILDINGS

PLANTING SOIL
32 91 00

- A. Prior to installation of Planting Soil, examine site to confirm that existing conditions are satisfactory for the work of this section to proceed.
 - 1. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope toward the under drain lines as shown on the drawings.
 - 2. Confirm that surface all areas to be filled with Planting Soil are free of construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches diameter, soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.
 - 3. Confirm that no adverse drainage conditions are present.
 - 4. Confirm that no conditions are present which are detrimental to plant growth.
 - 5. Confirm that utility work has been completed per the drawings.
 - 6. Confirm that irrigation work, which is shown to be installed below prepared soil levels, has been completed.
- B. If unsatisfactory conditions are encountered, notify the Landscape Architect immediately to determine corrective action before proceeding.

3.2 COORDINATION WITH PROJECT WORK

- A. The Contractor shall coordinate with all other work that may impact the completion of the work.
- B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.
- C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Landscape Architect of any conflicts encountered.

3.3 GRADE AND ELEVATION CONTROL

- A. Provide grade and elevation control during installation of Planting Soil. Utilize grade stakes, surveying equipment, and other means and methods to assure that grades and contours conform to the grades indicated on the plans.

3.4 SITE PREPARATION

- A. Excavate to the proposed subgrade. Maintain all required angles of repose of the adjacent materials as shown on the drawings or as required by this specification. Do not over excavate compacted subgrades of adjacent pavement or structures. Maintain a supporting 1:1 side slope of compacted subgrade material along the edges of all paving and structures where the bottom of the paving or structure is above the bottom elevation of the excavated planting area.
- B. Remove all construction debris and material including any construction materials from the subgrade.
- C. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope approximately parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.
- D. In areas where Planting Soil is to be spread, confirm subgrade has been scarified.
- E. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 1/2 inch plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.
 - 1. At the end of each working day, clean up any soil or dirt spilled on any paved surface.
 - 2. Any damage to the paving or site features or work shall be repaired at the Contractor's expense.

3.5 SOIL MOISTURE

- A. Volumetric soil moisture level, in both the Planting Soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilt point and below field capacity for each type of soil texture within the

following ranges.

Soil texture	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

- B. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). If moisture is found to be too low, the planting holes shall be filled with water and allowed to drain before starting any planting operations. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.6 EXISTING SOIL MODIFICATION

- A. Follow the requirements for modifying existing soil as indicated by the soils test and in Part 2 for the different types of soil modifications. The extent of the areas of different soil modification types to be reviewed by submittal to the Landscape Architect.

3.7 Drain pipe installation

- A. Trench lines to depths and widths shown on plans.
- B. Place 2 – 3 inches Coarse Sand as bedding for pipes.
- C. Place pipe (holes facing down) to invert elevations shown on the plan.
1. If pipe with holes on all sides is used drape a piece of 4 mil plastic 12 inches wide over top of pipe.
 2. Cover sides and top of pipe with Coarse Sand with min 4 inches of Coarse Sand cover above top of pipe.
 3. Backfill trench with Planting Soil compacted to same level as Planting Soil requirements.
- D. Add cleanout pipe reaching the surface at the uphill end of each pipe run as shown on drawings.
- E. Connect pipes to manhole or daylight outfall as shown on the drawings.

3.8 PLANTING SOIL and planting soil mix INSTALLATION ON GRADE

- A. Prior to installing any Planting Soil from stockpiles or Planting Soil Mixes blended off site, the Landscape Architect shall approve the condition of the subgrade and the previously installed subgrade preparation and the installation of subsurface drainage.
- B. All equipment utilized to install or grade Planting Soils shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery equipment shall have buckets equipped with 6 inch long teeth to scarify any soil that becomes compacted.
- C. In areas of soil installation above existing subsoil, scarify the subgrade material prior to installing Planting Soil.
1. Scarify the subsoil of the subgrade to a depth of 3 – 6 inches with the teeth of the back hoe or loader bucket, tiller or other suitable device.
 2. Immediately install the Planting Soil. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.
 3. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Planting Soil.

- D. Install the Planting Soil in 12 - 18 inch lifts to the required depths. Apply compacting forces to each lift as required to attain the required compaction. Scarify the top of each lift prior to adding more Planting Soil by dragging the teeth of a loader bucket or backhoe across the soil surface to roughen the surface.
- E. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts in one row before proceeding to the next. Work out from the furthest part of each bed from the soil delivery point to the edge of each bed area.
- F. Where possible place large trees first and fill Planting Soil around the root ball.
- G. Installing soil with soil or mulch blowers or soil slingers shall not be permitted due to the over mixing and soil ped breakdown cause by this type of equipment.
- H. Where travel over installed soil is unavoidable, limit paths of traffic to reduce the impact of compaction in Planting Soil. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. Comply with the paragraph "Compaction Reduction" (section 3.9) in the event that soil becomes over compacted.
- I. The depths and grades shown on the drawings are the final grades after settlement and shrinkage of the compost material. The Contractor shall install the Planting Soil at a higher level to anticipate this reduction of Planting Soil volume. A minimum settlement of approximately 10 - 15% of the soil depth is expected. All grade increases are assumed to be as measured prior to addition of surface Compost till layer, mulch, or sod.

3.9 COMPACTION REQUIREMENTS FOR INSTALLED OR MODIFIED PLANTING SOIL

- A. Compact installed Planting Soil to the compaction rates indicated and using the methods approved for the soil mockup. Compact each soil lift as the soil is installed.
- B. Existing soil that is modified by tilling, ripping or fracturing shall have a density to the depth of the modification, after completion of the loosening, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilting point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.
- C. Installed Planting Soil Mix and re-spread existing soil shall have a soil density through the required depth of the installed layers of soil, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilt point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.
- D. Planting Soil compaction shall be tested at each lift using a penetrometer calibrated to the mockup soil and its moisture level. The same penetrometer and moisture meter used for the testing of the mockup shall be used to test installed soil throughout the work.
- E. Maintain moisture conditions within the Planting Soil during installation or modification to allow for satisfactory compaction. Suspend operations if the Planting Soil becomes wet. Apply water if the soil is overly dry.
- F. Provide adequate equipment to achieve consistent and uniform compaction of the Planting Soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction. Use the same equipment and methods of compaction used to construct the Planting Soil mockup.
- G. Do not pass motorized equipment over previously installed and compacted soil except as authorized below.
 - 1. Light weight equipment such as trenching machines or motorized wheel barrows is permitted to pass over finished soil work.
 - 2. If work after the installation and compaction of soil compacts the soil to levels greater than the above requirements, follow the requirements of the paragraph "Over Compaction Reduction" below.

3.10 OVER COMPACTION REDUCTION

- A. Any soil that becomes compacted to a density greater than the specified density and/or the density in the approved mockup shall be dug up and reinstalled. This requirement includes compaction caused by other sub-contractors after the Planting Soil is installed and approved.
- B. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6 inches or greater

below finished grade.

3.11 INSTALLATION OF CHEMICAL ADDITIVES

- A. Following the installation of each soil and prior to fine grading and installation of the Compost till layer, apply chemical additives as recommended by the soil test, and appropriate to the soil and specific plants to be installed.
- B. Types, application rates and methods of application shall be approved by the Landscape Architect prior to any applications.

3.12 FINE GRADING

- A. The Landscape Architect shall approve all rough grading prior to the installation of Compost, fine grading, planting, and mulching.
- B. Grade the finish surface of all planted areas to meet the grades shown on the drawings, allowing the finished grades to remain higher (10 – 15% of depth of soil modification) than the grades on the grading plan, as defined in paragraph Planting Soil Installation, to anticipate settlement over the first year.
- C. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.
- D. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify the Landscape Architect in the event that conditions make it impossible to achieve positive drainage.
- E. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after settlement is one or two inches below all paving surfaces or as directed by the drawings.
- F. Fill all dips and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in shrub and ground cover planting areas shall be a 2 inch deviation from the plane in 10 feet. The tolerance for dips and bumps in lawn areas shall be a 1 inch deviation from the plane in 10 feet.

3.13 INSTALLATION OF COMPOST TILL LAYER

- A. After Planting Soil Mixes are installed in planting bed areas and just prior to the installation of shrub or groundcover plantings, spread 3 – 4 inches of Compost over the beds and roto till into the top 4 - 6 inches of the Planting Soil. This step will raise grades slightly above the grades required in paragraph "Fine Grading". This specification anticipates that the raise in grade due to this tilling will settle within a few months after installation as Compost breaks down. Additional settlement as defined in paragraph "Planting Soil and Planting Soil Mix installation" must still be accounted for in the setting of final grades.

3.14 CLEAN-UP

- A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
 - 1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.
- B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Landscape Architect seals are to remain on the trees and removed at the end of the warranty period.
 - 1. Make all repairs to grades, ruts, and damage to the work or other work at the site.
 - 2. Remove and dispose of all excess Planting Soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

3.15 PLANTING SOIL AND MODIFIED EXISTING SOIL PROTECTION

- A. The Contractor shall protect installed and/or modified Planting Soil from damage including contamination and over compaction due to other soil installation, planting operations, and operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Utilize fencing and matting as required or directed to protect the finished soil work. Treat, repair or replace damaged Planting Soil immediately.
- B. Loosen compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the Landscape Architect. Planting Soil shall be loosened or replaced at no expense to the Owner.
 - 1. Till and restore grades to all soil that has been driven over or compacted during the installation of plants.
 - 2. Where modified existing soil has become contaminated and needs to be replaced, provide imported soil that is of similar composition, depth and density as the soil that was removed.

3.16 PROTECTION DURING CONSTRUCTION

- A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers.
 - 1. Maintain protection during installation until the date of plant acceptance (see specifications section – Planting). Treat, repair or replace damaged work immediately.
 - 2. Provide temporary erosion control as needed to stop soil erosion until the site is stabilized with mulch, plantings or turf.
- B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Landscape Architect shall determine when such cleaning, replacement or repair is satisfactory. Damage to existing trees shall be assessed by a certified arborist.

3.17 SUBSTANTIAL COMPLETION ACCEPTANCE

- A. Upon written notice from the Contractor, the Landscape Architect shall review the work and make a determination if the work is substantially complete.
- B. The date of substantial completion of the planting soil shall be the date when the Landscape Architect accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

3.18 FINAL ACCEPTANCE / SOIL SETTLEMENT

- A. At the end of the plant warrantee and maintenance period, (see Specification section 32 93 00 - Planting) the Landscape Architect shall observe the soil installation work and establish that all provisions of the contract are complete, and the work is satisfactory.
 - 1. Restore any soil settlement and or erosion areas to the grades shown on the drawings. When restoring soil grades remove plants and mulch and add soil before restoring the planting. Do not add soil over the root balls of plants or on top of mulch.
- B. Failure to pass acceptance: If the work fails to pass final acceptance, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Landscape Architect.

END OF SECTION 32 9100

SECTION 32 9300
PLANTING

PART 1 – GENERAL

1.1 SUMMARY

- A. The scope of work includes 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 plant (also known as "landscaping") complete as shown on the drawings and as specified herein.
- B. The scope of work in this section includes, but is not limited to, the following:
 - 1. Locate, purchase, deliver and install all specified plants.
 - 2. Water all specified plants.
 - 3. Mulch, fertilize, stake, and prune all specified plants.
 - 4. Maintenance of all specified plants until the beginning of the warranty period.
 - 5. Plant warranty.
 - 6. Clean up and disposal of all excess and surplus material.
 - 7. Maintenance of all specified plants during the warranty period.

1.2 CONTRACT DOCUMENTS

- A. Shall consist of specifications and general conditions and the construction drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.3 REFERENCES

- A. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail or as determined by the Landscape Architect.
 - 1. State of California, Department of Food and Agriculture, Regulations for Nursery Inspections, Rules and Grading.
 - 2. ANSI Z60.1 American Standard for Nursery Stock, most current edition.
 - 3. ANSI A 300 – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current edition and parts.
 - 4. Interpretation of plant names and descriptions shall reference the following documents. Where the names or plant descriptions disagree between the several documents, the most current document shall prevail.
 - a. USDA - The Germplasm Resources Information Network (GRIN) <http://www.ars-grin.gov/npgs/searchgrin.html>
 - b. Manual of Woody Landscape Plants; Michael Dirr; Stipes Publishing, Champaign, Illinois; Most Current Edition.
 - c. The New Sunset Western Garden Book, Oxmoor House, most current edition.
 - 5. Pruning practices shall conform to recommendations "Structural Pruning: A Guide For The Green Industry" most current edition; published by Urban Tree Foundation, Visalia, California.
 - 6. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign IL, most current edition.

1.4 VERIFICATION

- A. All scaled dimensions on the drawings are approximate and diagrammatic. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Landscape Architect of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Landscape Architect.
- B. In the case of a discrepancy in the plant quantities between the plan drawings and the plant call outs, list or plant schedule, the number of plant symbols or square footage of the planting bed actually drawn on the plan drawings shall be deemed correct and prevail.

1.5 PERMITS AND REGULATIONS

- A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Landscape Architect in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.
- B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.
- C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply or Landscape Architect shall determine which shall govern.

1.6 PROTECTION OF WORK, PROPERTY AND PERSON

- A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

1.7 CHANGES IN THE WORK

- A. The Landscape Architect may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.
- B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.8 CORRECTION OF WORK

- A. The Contractor, at their own cost, shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Landscape Architect, at the soonest as possible time that can be coordinated with other work and seasonal weather demands.

1.9 DEFINITIONS

All terms in this specification shall be as defined in the "Glossary of Arboricultural Terms" or as modified below.

- A. Boxed trees: A container root ball package made of wood in the shape of a four-sided box.
- B. Container plant: Plants that are grown in and/or are currently in a container including boxed trees.
- C. Defective plant: Any plant that fails to meet the plant quality requirement of this specification.
- D. End of Warranty Final Acceptance: The date when the Landscape Architect accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation work run concurrent with each other.
- E. Field grown trees (B&B): Trees growing in field soil for at least 12 months prior to harvest.
- F. Healthy: Plants that are growing in a condition that expresses leaf size, crown density, color; and with annual

growth rates typical of the species and cultivar's horticultural description, adjusted for the planting site soil, drainage and weather conditions.

- G. Kinked root: A root within the root package that bends more than 90 degrees.
- H. Maintenance: Actions that preserve the health of plants after installation and as defined in this specification.
- I. Maintenance period: The time period, as defined in this specification, which the Contractor is to provide maintenance.
- J. Normal: the prevailing protocol of industry standard(s).
- K. Landscape Architect: The person appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Landscape Architect may appoint other persons to review and approve any aspects of the work.
- L. Reasonable and reasonably: When used in this specification relative to plant quality, it is intended to mean that the conditions cited will not affect the establishment or long term stability, health or growth of the plant. This specification recognizes that it is not possible to produce plants free of all defects, but that some accepted industry protocols and standards result in plants unacceptable to this project.

When reasonable or reasonably is used in relation to other issues such as weeds, diseased, insects, it shall mean at levels low enough that no treatment would be required when applying recognized Integrated Plant Management practices.

This specification recognizes that some decisions cannot be totally based on measured findings and that professional judgment is required. In cases of differing opinion, the Landscape Architect's expert shall determine when conditions are judged as reasonable.

- M. Root ball: The mass of roots including any soil or substrate that is shipped with the tree within the root ball package.
- N. Root ball package. The material that surrounds the root ball during shipping. The root package may include the material in which the plant was grown, or new packaging placed around the root ball for shipping.
- O. Root collar (root crown, root flare, trunk flare, flare): The region at the base of the trunk where the majority of the structural roots join the plant stem, usually at or near ground level.
- P. Shrub: Woody plants with mature height approximately less than 15 feet.
- Q. Spade harvested and transplanted: Field grown trees that are mechanically harvested and immediately transplanted to the final growing site without being removed from the digging machine.
- R. Stem: The trunk of the tree.
- S. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation where the Landscape Architect accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project.
- T. Stem girdling root: Any root more than ¼ inch diameter currently touching the trunk, or with the potential to touch the trunk, above the root collar approximately tangent to the trunk circumference or circling the trunk. Roots shall be considered as Stem Girdling that have, or are likely to have in the future, root to trunk bark contact.
- U. Structural root: One of the largest roots emerging from the root collar.
- V. Tree: Single and multi-stemmed plants with mature height approximately greater than 15 feet.

1.10 SUBMITTALS

- A. See contract general conditions for policy and procedure related to submittals.
- B. Submit all product submittals a minimum of 60 days prior to installation of plantings.

Shop drawings of root barrier layout.

- C. Product data: Submit manufacturer product data and literature describing all products required by this section to the Landscape Architect for approval. Provide submittal eight weeks before the installation of plants.
- D. Plant growers' certificates: Submit plant growers' certificates for all plants indicating that each meets the requirements of the specification, including the requirements of tree quality, to the Landscape Architect for approval. Provide submittal eight weeks before the installation of plants.
- E. Samples: Submit samples of each product and material where required by the specification to the Landscape Architect for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.
- F. Plant sources: Submit sources of all plants as required by Article – "Selection of Plants" to the Landscape Architect for approval.
 - 1. Include each plant's botanical name, size and quantity.
 - a. Requests for substitutions due to unavailability must be made in writing.
 - b. Substitutions may not be made without approval of the Architect.
 - c. Contractor shall notify Architect 24 hours in advance of delivery of plant materials and shall submit an itemized list of plants in each delivery.
- G. Photographs of Trees: Submit photographs of 24-inch boxed and larger trees available for selection at the nursery(ies) a minimum of the seven days prior to the tree tagging scheduled at the nursery.
- H. Label each photo with nursery name, plant name and size.
- I. Close out submittals: Submit to the Landscape Architect for approval.
 - 1. Plant maintenance data and requirements.

1.11 OBSERVATION OF THE WORK

- A. The Landscape Architect may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.
- B. The Landscape Architect shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Landscape Architect shall be afforded sufficient time to schedule visit to the site. Failure of the Landscape Architect to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.
 - 1. SITE CONDITIONS PRIOR TO THE START OF PLANTING: review the soil and drainage conditions.
 - 2. COMPLETION OF TREE LAYOUT. Review of the layout and facing of trees. Trees to be positioned in planting holes or pots and reviewed by Landscape Architect prior to backfill.
 - 3. COMPLETION OF THE PLANT LAYOUT STAKING OR CONTAINER PLACEMENT: Review of the plant layout.
 - 4. PLANT QUALITY: Review of plant quality at the time of delivery and prior to installation. Review tree quality prior to unloading where possible, but in all cases prior to planting.
 - 5. COMPLETION OF THE PLANTING: Review the completed planting.

1.12 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction meeting with the Landscape Architect at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.
- B. Notify the Landscape Architect a minimum of 72 hours in advance of all observations of planting.
- C. Notify the Landscape Architect a minimum of 72 hours in advance of nursery visits to select trees.

- D. Notify the Landscape Architect a minimum of seven days prior to the completion of planting walkthrough.

1.13 QUALITY ASSURANCE

- A. Substantial Completion Acceptance - Acceptance of the work prior to the start of the warranty period:
 - 1. Once the Contractor completes the installation of all items in this section, the Landscape Architect will observe all work for Substantial Completion Acceptance upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of the observation.
 - 2. Substantial Completion Acceptance by the Landscape Architect shall be for general conformance to specified size, character and quality and not relieve the Contractor of responsibility for full conformance to the contract documents, including correct species.
 - 3. Any plants that are deemed defective as defined under the provisions below shall not be accepted.
- B. The Landscape Architect will provide the Contractor with written acknowledgment of the date of Substantial Completion Acceptance and the beginning of the warranty period and plant maintenance period (if plant maintenance is included).
- C. Contractor's Quality Assurance Responsibilities: The Contractor is solely responsible for quality control of the work.
- D. Installer Qualifications: The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the work, including the handling and planting of large specimen trees in urban areas. The same firm shall install planting soil (where applicable) and plant material.
 - 1. The bidders list for work under this section shall be approved by the Landscape Architect.
 - 2. Installer Field Supervision: When any planting work is in progress, installer shall maintain, on site, a full-time supervisor who can communicate in English with the Landscape Architect.
 - 3. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing plants and trees of the quality and scale of the proposed project and can communicate in English with the Landscape Architect.
 - 4. The installer's crew shall have a minimum of 3 years experienced in the installation of Planting Soil, Plantings, and Irrigation (where applicable) and interpretation of soil plans, planting plans and irrigation plans.
 - 5. Submit references of past projects, employee training certifications that support that the Contractors meets all of the above installer qualifications and applicable licensures.

1.14 PLANT WARRANTY

- A. Plant Warranty:
 - 1. The Contractor agrees to replace poor, inadequate, defective materials and defective plants. The Landscape Architect shall make the final determination if plants meet these specifications or that plants are defective.

Plants warranty shall begin on the date of Substantial Completion Acceptance and continue for the following periods, classed by plant type:

 - a. Trees – One Year.
 - b. Palm Trees – Two Years
 - c. Shrubs – One Year
 - d. Ground cover and perennial flower plants – One Year.
 - e. Bulbs, annual flower and seasonal color plants – for the period of expected bloom or primary display.
 - 2. When the work is accepted in parts, the warranty periods shall extend from each of the partial Substantial Completion Acceptances to the terminal date of the last warranty period. Thus, all warranty periods for each class of plant warranty, shall terminate at one time.
 - 3. All plants shall be warrantied to meet all the requirements for plant quality at installation in this

specification. Defective plants shall be defined as plants not meeting these requirements. The Landscape Architect shall make the final determination that plants are defective.

4. Plants determined to be defective shall be removed within fifteen days upon notification by the Landscape Architect and replaced without cost to the Owner, within fifteen days or as soon as weather conditions permit and within the specified planting period.
 5. Any work required by this specification or the Landscape Architect during the progress of the work, to correct plant defects including the removal of roots or branches, or planting plants that have been bare rooted during installation to observe for or correct root defects shall not be considered as grounds to void any conditions of the warranty. In the event that the Contractor decides that such remediation work may compromise the future health of the plant, the plant or plants in question shall be rejected and replaced with plants that do not contain defects that require remediation or correction.
 6. The Contractor is exempt from replacing plants, after Substantial Completion Acceptance and during the warranty period, that are removed by others, lost or damaged due to occupancy of project, lost or damaged by a third party, vandalism, or any natural disaster.
 7. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.
 8. The warranty of all replacement plants shall extend for an additional one-year period from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended warranty period, the Landscape Architect may elect one more replacement items or credit for each item. These tertiary replacement items are not protected under a warranty period.
 9. During and by the end of the warranty period, remove all tree wrap, ties, and guying unless agreed to by the Landscape Architect to remain in place. All trees that do not have sufficient caliper to remain upright, or those requiring additional anchorage in windy locations, shall be staked or remain staked, if required by the Landscape Architect.
- B. End of Warranty Final Acceptance - Acceptance of plants at the end of the warranty period.
1. At the end of the warranty period, the Landscape Architect shall observe all warranted work, upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date for final observation.
 2. End of Warranty Final Acceptance will be given only when all the requirements of the work under this specification and in specification sections Planting Soil and Irrigation have been met.

1.15 SELECTION AND OBSERVATION OF PLANTS

- A. The Landscape Architect may review all plants subject to approval of size, health, quality, character, etc. Review or approval of any plant during the process of selection, delivery, installation and establishment period shall not prevent that plant from later rejection in the event that the plant quality changes or previously existing defects become apparent that were not observed.
- B. Plant Selection: The Landscape Architect reserves the right to select and observe all plants at the nursery prior to delivery and to reject plants that do not meet specifications as set forth in this specification. If a particular defect or substandard element can be corrected at the nursery, as determined by the Landscape Architect, the agreed upon remedy may be applied by the nursery or the Contractor provided that the correction allows the plant to meet the requirements set forth in this specification. Any work to correct plant defects shall be at the contractor's expense.
1. The Landscape Architect may make invasive observation of the plant's root system in the area of the root collar and the top of the root ball in general in order to determine that the plant meets the quality requirements for depth of the root collar and presence of roots above the root collar. Such observations will not harm the plant.
 2. Corrections are to be undertaken at the nursery prior to shipping.
- C. The Contractor shall bear all cost related to plant corrections.

- D. All plants that are rejected shall be immediately removed from the site and acceptable replacement plants provided at no cost to the Owner.
- E. Submit to the Landscape Architect, for approval, plant sources including the names and locations of nurseries proposed as sources of acceptable plants, and a list of the plants they will provide. The plant list shall include the botanical and common name and the size at the time of selection. Observe all nursery materials to determine that the materials meet the requirements of this section.
- F. Trees shall be purchased from the growing nursery. Re-wholesale plant suppliers shall not be used as sources unless the Contractor can certify that the required trees are not directly available from a growing nursery. When Re-wholesale suppliers are utilized, the Contractor shall submit the name and location of the growing nursery from where the trees were obtained by the re-wholesale seller. The re-wholesale nursery shall be responsible for any required plant quality certifications.
- G. The Contractor shall require the grower or re-wholesale supplier to permit the Landscape Architect to observe the root system of all plants at the nursery or job site prior to planting including random removal of soil or substrate around the base of the plant. Observation may be as frequent and as extensive as needed to verify that the plants meet the requirements of the specifications and conform to requirements.
- H. Each tree shall have a numbered seal applied by the Contractor. The seal shall be placed on a lateral branch on the north side of the tree. The seal shall be a tamper proof plastic seal bearing the Contractors name and a unique seven-digit number embossed on the seal.
 - 1. Do not place seals on branches that are so large that there is not sufficient room for the branch growth over the period of the warranty.
- I. The Landscape Architect may choose to attach their seal to each plant, or a representative sample. Viewing and/or sealing of plants by the Landscape Architect at the nursery does not preclude the Landscape Architect's right to reject material while on site. The Contractor is responsible for paying any up charge for the Landscape Architect to attach their seal to specific plants.
- J. The Contractor shall coordinate up to two tree selection visits with local nurseries for the Landscape Architect to select trees and attach their seal to each tree.
 - 1. Each tree selection visit shall be defined as the Landscape Architect traveling to a single nursery or a maximum of two nurseries within ten miles distance from one another.
 - 2. A local nursery shall be defined as a nursery within fifty miles of downtown Los Angeles, California.
 - 3. Nurseries selected by the contractor shall stock and have available for review and tagging 200 percent the quantity of the specified tree.
 - 4. No photographs will be accepted for the final selection of trees.
 - 5. Failure to comply with the tree selection visit requirements listed above shall make the Contractor responsible for reimbursing the Landscape Architect for the nursery visit(s) at their current hourly billing rate plus transportation costs. No further tree selection visits will be scheduled until this charge has been paid and received.
- K. Where requested by the Landscape Architect, submit photographs of plants or representative samples of plants. Photographs shall be legible and clearly depict the plant specimen. Each submitted image shall contain a height reference, such as a measuring stick. The approval of plants by the Landscape Architect via photograph does not preclude the Landscape Architect's right to reject material while on site.

1.16 PLANT SUBSTITUTIONS FOR PLANTS NOT AVAILABLE

- A. Submit all requests for substitutions of plant species, or size to the Landscape Architect, for approval, prior to purchasing the proposed substitution. Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution.

1.17 SITE CONDITIONS

- A. It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to notify the Landscape Architect, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
 - 1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Landscape Architect in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Landscape Architect of such conditions, he/she shall remain responsible for plant material under the warranty clause of the specifications.
- B. It is the responsibility of the Contractor to be familiar with the local growing conditions, and if any specified plants will be in conflict with these conditions. Report any potential conflicts, in writing, to the Landscape Architect.
- C. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.
 - 1. Planting operations shall not begin until such time that the irrigation system is completely operational for the area(s) to be planted, and the irrigation system for that area has been preliminarily observed and approved by the Landscape Architect.
- D. Actual planting shall be performed during those periods when weather and soil conditions are suitable in accordance with locally accepted horticultural practices.
 - 1. Do not install plants into saturated or frozen soils. Do not install plants during inclement weather, such as rain or snow or during extremely hot, cold or windy conditions.

1.18 PLANTING AROUND UTILITIES

- A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Notification of *DigAlert*, 811, is required for all planting areas: The Contractor is responsible for knowing the location and avoiding utilities that are not covered by the *DigAlert*

PART 2 – PRODUCTS

2.1 PLANTS: GENERAL

- A. Standards and measurement: Provide plants of quantity, size, genus, species, and variety or cultivars as shown and scheduled in contract documents.
 - 1. All plants including the root ball dimensions or container size to trunk caliper ratio shall conform to ANSI Z60.1 “American Standard for Nursery Stock” latest edition, unless modified by provisions in this specification. When there is a conflict between this specification and ANSI Z60.1, this specification section shall be considered correct.
 - 2. Plants larger than specified may be used if acceptable to the Landscape Architect. Use of such plants shall not increase the contract price. If larger plants are accepted the root ball size shall be in accordance with ANSI Z-60.1. Larger plants may not be acceptable if the resulting root ball cannot be fit into the required planting space.
 - 3. If a range of size is given, no plant shall be less than the minimum size and not less than 50 percent of the plants shall be as large as the maximum size specified. The measurements specified are the minimum and maximum size acceptable and are the measurements after pruning, where pruning is

required.

- B. Proper Identification: All trees shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by genus, species, variety and cultivar.
- C. Compliance: All trees shall comply with federal and state laws and regulations requiring observation for plant disease, pests, and weeds. Observation certificates required by law shall accompany each shipment of plants.
- D. All plants and planting materials that meet or exceed specifications of Federal, State, and County laws requiring inspection for plant disease or insect control.
- E. Provide plants that are true to name. Tag one of each bundle or lot with the name and size of plants in accordance with the standards of practice the American Nursery & Landscape Association.
- F. Botanical names shall take precedence over common names.
- G. Plants shall be in conformance with the California State Department of Agriculture's regulation for nursery inspections, rules, and ratings. Plants shall be healthy, vigorous, and free of insect infestations, plant diseases, sunscalds, frost burns, abrasions, or other disfigurement. Plants shall be grown in climatic conditions similar to that of the planting site, and well hardened off. Plants shall have vigorous fibrous root systems which are not rootbound or pot bound. The Architect is the sole judge as to acceptability of plant material.
- H. Plant Quality:
 - 1. General: Provide healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores, and larvae. At the time of planting all plants shall have a root system, stem, and branch form that will not restrict normal growth, stability and health for the expected life of the plant.
 - 2. Plant quality above the soil line:
 - a. Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type specified. Tree quality be accepted by the Landscape Architect:
 - 1.) Crown: The form and density of the crown shall be typical for a young specime of the species or cultivar pruned to a central and dominant leader.
 - a.) Crown specifications do not apply to plants that have been specifically trained in the nursery as topiary, espalier, multi-stem, clump, or unique selections such as contorted or weeping cultivars.
 - 2.) Leaves: The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Trees shall not show signs of prolonged moisture stress or over watering as indicated by wilted, shriveled, or dead leaves.
 - 3.) Branches: Shoot growth (length and diameter) throughout the crown should be appropriate for the age and size of the species or cultivar. Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.
 - a.) Main branches shall be distributed along the central leader not clustered together. They shall form a balanced crown appropriate for the cultivar/species.
 - b.) Branch diameter shall be no larger than two-thirds (one-half is preferred) the diameter of the central leader measured 1 inch above the branch union.
 - c.) The attachment of the largest branches (scaffold branches) shall be free of included bark.
 - 4.) Trunk: The tree trunk shall be relatively straight, vertical, and free of wounds that penetrate to the wood (properly made pruning cuts, closed or not, are acceptable and are not considered wounds), sunburned areas, conks (fungal fruiting bodies), wood cracks, sap leakage, signs of boring insects, galls, cankers, girdling ties, or lesions (mechanical injury).
 - 5.) Temporary branches, unless otherwise specified, can be present along the lower trunk below

the lowest main (scaffold) branch, particularly for trees less than 1 inch in caliper. These branches should be no greater than 3/8-inch diameter. Clear trunk should be no more than 40% of the total height of the tree.

- b. Trees shall have one central leader. If the leader was headed, a new leader (with a live terminal bud) at least one-half the diameter of the pruning cut shall be present.
 - 1.) All trees are assumed to have one central leader trees unless a different form is specified in the plant list or drawings.
 - c. All graft unions, where applicable, shall be completely closed without visible sign of graft rejection. All grafts shall be visible above the soil line.
 - d. Trunk caliper and taper shall be sufficient so that the lower five feet of the trunk remains vertical without a stake. Auxiliary stake may be used to maintain a straight leader in the upper half of the tree.
3. Plant quality at or below the soil line:
- a. Plant roots shall be normal to the plant type specified. Root observations shall take place without impacting tree health. Root quality at or below the soil line shall comply with the project Root Acceptance details and the following:
 - 1.) The roots shall be reasonably free of scrapes, broken or split wood.
 - 2.) The root system shall be reasonably free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Wounds resulting from root pruning used to produce a high quality root system are not considered injuries.
 - 3.) A minimum of three structural roots reasonably distributed around the trunk (not clustered on one side) shall be found in each plant. Root distribution shall be uniform throughout the root ball, and growth shall be appropriate for the species.
 - a.) Plants with structural roots on only one side of the trunk (J roots) shall be rejected.
 - 4.) The root collar shall be within the upper 2 inches of the substrate/soil. Two structural roots shall reach the side of the root ball near the top surface of the root ball. The grower may request a modification to this requirement for species with roots that rapidly descend, provided that the grower removes all stem girdling roots above the structural roots across the top of the root ball.
 - 5.) The root system shall be reasonably free of stem girdling roots over the root collar or kinked roots from nursery production practices.
 - a.) Plant Grower Certification: The final plant grower shall be responsible to have determined that the plants have been root pruned at each step in the plant production process to remove stem girdling roots and kinked roots, or that the previous production system used practices that produce a root system throughout the root ball that meets these specifications. Regardless of the work of previous growers, the plant's root system shall be modified at the final production stage, if needed, to produce the required plant root quality. The final grower shall certify in writing that all plants are reasonably free of stem girdling and kinked roots as defined in this specification, and that the tree has been grown and harvested to produce a plant that meets these specifications.
 - 6.) At time of observations and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.
- I. Submittals: Submit for approval the required plant quality certifications from the grower where plants are to be purchased, for each plant type. The certification must state that each plant meets all the above plant quality requirements.

- 1. The grower's certification of plant quality does not prohibit the Landscape Architect from observing any

plant or rejecting the plant if it is found to not meet the specification requirements.

- 2.2 ROOT BALL PACKAGE OPTIONS: The following root ball packages are permitted. Specific root ball packages shall be required where indicated on the plant list or in this specification. Any type of root ball packages that is not specifically defined in this specification shall not be permitted.

A. CONTAINER (INCLUDING ABOVE-GROUND FABRIC CONTAINERS AND BOXES) PLANTS

1. Container plants may be permitted only when indicated on the drawing, in this specification, or approved by the Landscape Architect.
2. Provide plants shall be established and well rooted in removable containers.
3. Container class size shall conform to ANSI Z60.1 for container plants for each size and type of plant.
4. Five gallon and larger container plants shall have been grown in containers for a minimum of six months and maximum of two years. Plants shall be furnished on site free of pests or diseases and exhibit healthy growth.

2.3 ANNUAL FLOWERING AND SEASONAL COLOR PLANTS

- A. Container or flat-grown plants should be sized as noted in the planting plan. Plants shall be well-rooted and healthy.

2.4 PLANTING SOIL

- A. Planting Soil as used in this specification means the soil at the planting site, or imported as modified and defined in specification Section Planting Soil. If there is no Planting Soil specification, the term Planting Soil shall mean the soil at the planting site within the planting hole.

2.5 MULCH

- A. Mulch shall be "Walk on" grade, coarse, ground, from tree and woody brush sources. The size range shall be a minimum (less than 25% or less of volume) fine particles 3/8 inch or less in size, and a maximum size of individual pieces (largest 20% or less of volume) shall be approximately 1 to 1-1/2 inch in diameter and maximum length approximately 4 to 8". Pieces larger than 8 inch long that are visible on the surface of the mulch after installation shall be removed.
1. It is understood that mulch quality will vary significantly from supplier to supplier and region to region. The above requirements may be modified to conform to the source material from locally reliable suppliers as approved by the Landscape Architect.
 2. Shredded lumber products will not be accepted.
- B. Subject to compliance with requirements, provide products by the following:
1. Walk On Bark, Sequoia Horticultural Products, PO Box 963, Dinuba, CA 93618; 559-591-1177.
 - a. 1/4 inch to 3 inches, fibrous, bark nuggets and cambium wood,
 - b. Fir or Pine
 2. Forest Floor Mulch, Aguinaga Green, 410 West Grove Avenue, Orange, CA 92865; 1877-OC-MULCH
 3. Approved Equal

2.6 TREE STAKING AND GUYING MATERIAL

A. Tree guying

1. Flexible vinyl tree ties meeting ASTM-D-412 standards for tensile and elongation strength. Material shall be black.
2. Each tie shall be a single piece, not multiple ties joined together.
3. Subject to compliance with requirements, provide products by the following:
 - a. VIT Cinch Tie

- b. VIT Cinch Belt (larger trees)
 - c. Villa Root Barrier E-Z Band
 - d. Approved Equal
- B. Stakes shall be lodge pole pine stakes free of knots and of diameters and lengths appropriate to the size of plant as required to adequately support the plant.
 - 1. Fully treated with CuNap, ACQ or other non-arsenic wood preservative.
 - 2. Do not split stakes.
 - 3. Sizes
 - a. Two inch diameter (nom.) by 10 foot long for 24-inch box and smaller Trees
 - b. Three inch diameter (nom.) by 12 foot long for 36-inch box trees
- C. Guying Hardware:
 - 1. Wire: Pliable 1/8" galvanized steel cable.
 - 2. Hose: 1/2" new black rubber hose.
 - 3. Turnbuckles: galvanized or dip-painted, size as required.
 - 4. Cable clamps: galvanized, size as required.
 - 5. Safety Sleeve: 1/2" white PVC full length of wire.
 - 6. Steel Guy Anchor: Duckbill Anchor by Foresight Products (800) 325-5360; Platypus Tree Anchoring Systems (866) 752-8478, or equal. Size as needed.
- D. Submit manufacturer's product data for approval.

2.7 TREE BARK PROTECTOR

- A. Tree Bark Protectors shall be gray, brown color extruded resin mesh, 4 inches in diameter, 5 feet long, 1.52 millimeters thick UV inhibited polyethylene.
- B. Subject to compliance with requirements, provide products by the following:
 - 1. Industrial Netting, Minneapolis, MN.
 - 2. Approved Equal
- C. Fasten the split side of the Tree Bark Protector together in three places with black plastic tape.
- D. Submit manufacturers' product data for approval.

2.8 WATERING BAGS

- A. Plastic tree watering bags holding a minimum of 15 gallons of water and with a slow drip hole(s) water release system, specifically designed to water establishing trees. Water should release over a several day period, not within a few hours
- B. Subject to compliance with requirements, provide products by the following:
 - 1. Treegator Irrigation Bags sized to the appropriate model for the requirements of the plant, manufactured by Spectrum Products, Inc., Youngsville, NC 27596.
 - 2. Ooze Tube sized to the appropriate model for the requirements of the plant, manufactured by Engineered Water Solutions, Atlanta, GA.
 - 3. Or approved equal.
- C. Submit manufacturer's product data for approval.

2.9 CHEMICAL OR BIOLOGICAL ADDITIVES

A. PLANT TABLETS

1. 7-gram planting tablet designed for 12 month slow release.
2. 12-8-8 NPK, 20% humus, 4% humic acids, 3.5% sulfur, 2% iron, micronutrients.

B. Submit manufacturers' product data for approval.

2.10 WATER

A. Furnish Contractor if Owner is unable to furnish acceptable water.

B. Transport by Contractor as required.

2.11 DRAINAGE MATERIAL

A. 3/8" Crushed Angular Rock

1. 95% -100% passing through a 3/8" screen.
2. 0-5% passing through No. 8 mesh.
3. 80-100# per cubic yard.

B. Submit manufacturers' product data for approval.

2.12 DRAIN PIPES (DRAINAGE SUMP)

A. Sub-Surface perforated or non-perforated as indicated on Plans, size and type noted, manufactured by Lasco, National Diversified Sales (NDS) or Advanced Drainage Systems, Inc. Perforated pipe shall be completely wrapped with a water permeable nylon screen that is lapped and welded around the pipe, and surrounded by minimum 4" thickness of coarse sand or gravel, unless otherwise noted on Plans.

B. Planter Area Drainpipe and Fixtures: National Diversified Sales (NDS) SDR 35 fittings and SDR 35 drainpipes with specified grates, color black, and size and type per plan. NDS, Newbury Park, California, telephone: (800) 726-1994.

2.13 SOIL SEPARATOR

A. Nonwoven polypropylene fabric

1. needle-punched
2. UV Resistance of 70%
3. AOS of 70 US Standard sieve
4. Water flow rate of 110 gpm/ft2.

B. Subject to compliance with requirements, provide products by the following:

1. Geotex 701, manufactured by Propex,
2. Approved Equal

C. Submit manufacturers' product data for approval.

2.14 WEED CONTROL FABRIC

A. Spun-bonded polypropylene with UV inhibitors, non-degrading geotextile fabric that blocks 95% of weed growth and is permeable to air, water, gasses and fertilizer. Typar 3301 or equal.

1. Properties:
 - a. Unit Weight: 3.0 oz/yds²
 - b. Tensile Strength: 135 pounds
 - c. Puncture Strength: 35 pounds
 - d. Air Opening Size: 60/70 equivalent sieve

- e. Elongation at Break: <70%
- f. Trap Tear: 50 pounds
- g. Flux: 70 gal/ft²/min
- h. Permittivity: 1.2 sec-2
- i. Color: Black

B. Submit manufacturers' product data for approval.

2.15 ROOT BARRIER

- A. A root barrier is required when the center of the trunk of the tree is within six feet of adjacent pavement, walls, curbs, building or other structure.
- B. Polyethylene (0.08 inch thick) or polypropylene (2.032 - 2.16 mm thick) barrier
 - 1. Self-locking joiners
 - 2. ½" raised 90 degree molded root deflecting ribs
 - 3. Ground lock tabs
 - 4. Double top edge
 - 5. UV inhibitors.
 - 6. Thirty-six inches tall by twelve feet long unless otherwise stated
- C. Submit manufacturers' product data for approval.

PART 3 – EXECUTION

3.1 SITE EXAMINATION

- A. Examine the surface grades and soil conditions to confirm that the requirements of the Specification Section – Planting Soil - and the soil and drainage modifications indicated on the Planting Soil Plan and Details (if applicable) have been completed. Notify the Landscape Architect in writing of any unsatisfactory conditions.

3.2 DELIVERY, STORAGE AND HANDLING

- A. Protect materials from deterioration during delivery and storage. Adequately protect plants from drying out, exposure of roots to sun, wind or extremes of heat and cold temperatures. If planting is delayed more than 24 hours after delivery, set plants in a location protected from sun and wind. Provide adequate water to the root ball package during the shipping and storage period.
 - 1. All plant materials must be available for observation prior to planting.
 - 2. Using a soil moisture meter, periodically check the soil moisture in the root balls of all plants to assure that the plants are being adequately watered. Volumetric soil moisture shall be maintained above wilting point and below field capacity for the root ball substrate or soil.
- B. Do not deliver more plants to the site than there is space with adequate storage conditions. Provide a suitable remote staging area for plants and other supplies.
 - 1. The Landscape Architect or Contractor shall approve the duration, method and location of storage of plants.
- C. Provide protective covering over all plants during transporting.

3.3 PLANTING SEASON

- A. Planting shall only be performed when weather and soil conditions are suitable for planting the materials specified in accordance with locally accepted practice.
- B. Install plants during the planting time as described below unless otherwise approved in writing by the

Landscape Architect. In the event that the Contractor request planting outside the dates of the planting season, approval of the request does not change the requirements of the warranty.

1. Seeding and Hydro-seeding -- November to December

3.4 ADVERSE WEATHER CONDITIONS

- A. NO PLANTING SHALL TAKE PLACE DURING EXTREMELY HOT, DRY, WINDY OR FREEZING WEATHER.

3.5 COORDINATION WITH PROJECT WORK

- A. The Contractor shall coordinate with all other work that may impact the completion of the work.
- B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.
- C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Landscape Architect of any conflicts encountered.

3.6 LAYOUT AND PLANTING SEQUENCE

- A. Relative positions of all plants and trees are subject to approval of the Landscape Architect.
- B. Notify the Landscape Architect, one (1) week prior to layout. Layout all individual tree and shrub locations. Place plants above surface at planting location or place a labeled stake at planting location. Layout bed lines with paint for the Landscape Architect's approval. Secure the Landscape Architect's acceptance before digging and start of planting work.
- C. When applicable, plant trees before other plants are installed.
- D. It is understood that plants are not precise objects and that minor adjustments in the layout will be required as the planting plan is constructed. These adjustments may not be apparent until some or all of the plants are installed. Make adjustments as required by the Landscape Architect including relocating previously installed plants.

3.7 SOIL PROTECTION DURING PLANT DELIVERY AND INSTALLATION

- A. Protect soil from compaction during the delivery of plants to the planting locations, digging of planting holes and installing plants.
 1. Where possible deliver and plant trees that require the use of heavy mechanized equipment prior to final soil preparation and tilling. Where possible, restrict the driving lanes to one area instead of driving over and compacting a large area of soil.
 2. Till to a depth of 6 inches, all soil that has been driven over during the installation of plants.

3.8 SOIL MOISTURE

- A. Volumetric soil moisture level, in both the planting soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilting point and below field capacity for each type of soil texture within the following ranges.

Soil type	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

1. Volumetric soil moisture shall be measured with a digital moisture meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent.

- B. The Contractor shall confirm the soil moisture levels with a moisture meter. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.9 INSTALLATION OF PLANTS: GENERAL

- A. Observe each plant after delivery and prior to installation for damage of other characteristics that may cause rejection of the plant. Notify the Landscape Architect of any condition observed.
- B. No more plants shall be distributed about the planting bed area than can be planted and watered on the same day.
- C. The root system of each plant, regardless of root ball package type, shall be observed by the Contractor, at the time of planting to confirm that the roots meet the requirements for plant root quality in Part 2 Products: Plants General: Plant Quality. The Contractor shall undertake at the time of planting, all modifications to the root system required by the Landscape Architect to meet these quality standards.
 - 1. Modifications, at the time of planting, to meet the specifications for the depth of the root collar and removal of stem girdling roots and circling roots may make the plant unstable or stress the plant to the point that the Landscape Architect may choose to reject the plant rather than permitting the modification.
 - 2. Any modifications required by the Landscape Architect to make the root system conform to the plant quality standards outlined in Part 2 Products: Plants General: Quality, or other requirements related to the permitted root ball package, shall not be considered as grounds to modify or void the plant warranty.
 - 3. The resulting root ball may need additional staking and water after planting. The Landscape Architect may reject the plant if the root modification process makes the tree unstable or if the tree is not healthy at the end of the warranty period. Such plants shall still be covered under the warranty.
 - 4. The Contractor remains responsible to confirm that the grower has made all required root modifications noted during any nursery observations.
- D. Container and Boxed Root Ball Shaving: The outer surfaces of ALL plants in containers and boxes, including the top, sides and bottom of the root ball shall be shaved to remove all circling, descending, and matted roots. Shaving shall be performed using saws, knives, sharp shovels or other suitable equipment that is capable of making clean cuts on the roots. Shaving shall remove a minimum of one inch of root mat or up to 2 inches as required to remove all root segments that are not growing reasonably radial to the trunk.
- E. Exposed Stem Tissue after Modification: The required root ball modifications may result in stem tissue that has not formed trunk bark being exposed above the soil line. If such condition occurs, wrap the exposed portion of the stem in a protective wrapping with a white filter fabric. Secure the fabric with biodegradable masking tape. DO NOT USE string, twine, green nursery ties or any other material that may girdle the trunk if not removed.
- F. Excavation of the Planting Space: Using hand tools or tracked mini-excavator, excavate the planting hole into the Planting Soil to the depth of the root ball measured after any root ball modification to correct root problems, and wide enough for working room around the root ball or to the size indicated on the drawing or as noted below.
 - 1. For trees and shrubs planted in soil areas that are NOT tilled or otherwise modified to a depth of at least 12 inches over a distance of more than 10 feet radius from each tree, or 5 feet radius from each shrub, the soil around the root ball shall be loosened as defined below or as indicated on the drawings.
 - a. The area of loosening shall be a minimum of 3 times the diameter of the root ball at the surface sloping to 2 times the diameter of the root ball at the depth of the root ball.
 - b. Loosening is defined as digging into the soil and turning the soil to reduce the compaction. The soil does not have to be removed from the hole, just dug, lifted and turned. Lifting and turning may be accomplished with a tracked mini excavator, or hand shovels.
 - 2. If an auger is used to dig the initial planting hole, the soil around the auger hole shall be loosened as defined above for trees and shrubs planted in soil areas that are NOT tilled or otherwise modified.
 - 3. The measuring point for root ball depth shall be the average height of the outer edge of the root ball after any required root ball modification.

4. If motorized equipment is used to deliver plants to the planting area over exposed planting beds, or used to loosen the soil or dig the planting holes, all soil that has been driven over shall be tilled to a depth of 6 inches.
- G. For trees to be planted in prepared Planting Soil that is deeper than the root ball depth, compact the soil under the root ball using a mechanical tamper to assure a firm bedding for the root ball. If there is more than 12 inches of planting soil under the root ball excavate and tamp the planting soil in lifts not to exceed 12 inches.
- H. Set top outer edge of the root ball at the average elevation of the proposed finish. Set the plant plumb and upright in the center of the planting hole. The tree graft, if applicable, shall be visible above the grade. Do not place soil on top of the root ball.
- I. The Landscape Architect may request that plants orientation be rotated when planted based on the form of the plant.
- J. Backfill the space around the root ball with the same planting soil or existing soil that was excavated for the planting space. See Specification Section Planting Soil, for requirements to modify the soil within the planting bed.
- K. Brace root ball by tamping Planting Soil around the lower portion of the root ball. Place additional Planting Soil around base and sides of ball in six-inch (6") lifts. Lightly tamp each lift using foot pressure or hand tools to settle backfill, support the tree and eliminate voids. DO NOT over compact the backfill or use mechanical or pneumatic tamping equipment. Over compaction shall be defined as greater than 85% of maximum dry density, standard proctor or greater than 250 psi as measured by a cone penetrometer when the volumetric soil moisture is lower than field capacity.
 1. When the planting hole has been backfilled to three quarters of its depth, water shall be poured around the root ball and allowed to soak into the soil to settle the soil. Do not flood the planting space. If the soil is above field capacity, allow the soil to drain to below field capacity before finishing the planting. Air pockets shall be eliminated and backfill continued until the planting soil is brought to grade level.
- L. Where indicated on the drawings, build a 4 inch high, level berm of Planting Soil around the outside of the root ball to retain water. Tamp the berm to reduce leaking and erosion of the saucer.
- M. Thoroughly water the Planting Soil and root ball immediately after planting.
- N. Remove all nursery plant identification tags and ribbons as per Landscape Architect instructions. The Landscape Architect's seals are to remain on plants until the end of the warranty period.
- O. Remove corrugated cardboard trunk protection after planting.
- P. Follow additional requirements for the permitted root ball packages.

3.10 PERMITTED ROOT BALL PACKAGES AND SPECIAL PLANTING REQUIREMENTS

- A. The following are permitted root ball packages and special planting requirements that shall be followed during the planting process in addition to the above General planting requirements.
- B. CONTAINER (INCLUDES BOXED AND ABOVE-GROUND FABRIC CONTAINERS) PLANTS
 1. This specification assumes that most container plants have significant stem girdling and circling roots, and that the root collar is too low in the root ball.
 2. Remove the container.
 3. Perform root ball shaving as defined in Installation of Plants: General above.
 4. Remove all roots and substrate above the root collar and the main structural roots according to root correction details so root system conforms to root observations detail.
 5. Remove all substrate at the bottom of the root ball that does not contain roots.
 6. Using a hose, power washer or air excavation device, wash out the substrate from around the trunk and top of the remaining root ball and find and remove all stem girdling roots within the root ball above the top of the structural roots.

C. IN-GROUND FABRIC CONTAINERS

1. Remove the fabric container from the root ball. Cut roots at the edge of the container as needed to extract the fabric from the roots. Make clean cuts with sharp tools; do not tear roots away from the fabric.
2. Observe the root system after the container is removed to confirm that the root system meets the quality standards.

3.11 GROUND COVER, PERENNIAL AND ANNUAL PLANTS

- A. Where ground cover is shown on plans, groundcover planting continues under shrubs and trees at specified spacing. Ground cover shall not be planted in the shrub or tree watering basins per the contract details.
- B. Assure that soil moisture is within the required levels prior to planting. Irrigation, if required, shall be applied at least 12 hours prior to planting to avoid planting in muddy soils.
- C. Assure that soil grades in the beds are smooth and as shown on the plans.
- D. Plants shall be planted in even, triangularly spaced rows, at the intervals called out for on the drawings, unless otherwise noted. The first row of Annual flower plants shall be 6 inches from the bed edge unless otherwise directed.
- E. Dig planting holes sufficiently large enough to insert the root system without deforming the roots. Set the top of the root system at the grade of the soil.
- F. Schedule the planting to occur prior to application of the mulch. If the bed is already mulched, pull the mulch from around the hole and plant into the soil. Do not plant the root system in the mulch. Pull mulch back so it is not on the root ball surface.
- G. Press soil to bring the root system in contact with the soil.
- H. Spread any excess soil around in the spaces between plants.
- I. Apply mulch to the bed being sure not to cover the tops of the plants with or the tops of the root ball with mulch.
- J. Water each planting area as soon as the planting is completed. Apply additional water to keep the soil moisture at the required levels. Do not over water.

3.12 STAKING AND GUYING

- A. Do not stake or guy trees unless specifically required by the Contract Documents, or in the event that the Contractor feels that staking is the only alternative way to keep particular trees plumb.
 1. The Landscape Architect shall have the authority to require that trees are staked or to reject staking as an alternative way to stabilize the tree.
 2. Trees that required heavily modified root balls to meet the root quality standards may become unstable. The Landscape Architect may choose to reject these trees rather than utilize staking to temporarily support the tree.
- B. Trees that are guyed shall have their guys and stakes removed after one full growing season or at other times as required by the Landscape Architect.
- C. Tree guying shall utilize the tree staking and guying materials specified. Guying to be tied in such a manner as to create a minimum 12-inch loop to prevent girdling. Refer to manufacturer's recommendations and the planting detail for installation.
 1. Plants shall stand plumb after staking or guying.
 2. Stakes shall be driven to sufficient depth to hold the tree rigid.
- D. For trees planted in planting mix over waterproofed membrane, use dead men buried 24 inches to the top of the dead man, in the soil. Tie the guy to the dead man with a double wrap of line around the dead man followed by a double half hitch. When guys are removed, leave the dead men in place and cut the guy tape 12 inches above the ground, leaving the tape end covered in mulch.

3.13 TREE BARK PROTECTION

- A. For all street trees in commercial areas where indicated on the drawings, apply a Tree Bark Protector to each tree.

3.14 STRAIGHTENING PLANTS

- A. Maintain all plants in a plumb position throughout the warranty period. Straighten all trees that move out of plumb including those not staked. Plants to be straightened shall be excavated and the root ball moved to a plumb position, and then re-backfilled.
- B. Do not straighten plants by pulling the trunk with guys.

3.15 INSTALLATION OF FERTILIZER AND OTHER CHEMICAL ADDITIVES

- A. Do not apply any soluble fertilizer to plantings during the first year after transplanting unless soil test determines that fertilizer or other chemical additives is required. Apply chemical additives only upon the approval of the Landscape Architect.
- B. Controlled release fertilizers shall be applied according to the manufacturer's instructions and standard horticultural practices.

3.16 PRUNING OF TREES AND SHRUBS

- A. Prune plants as directed by the Landscape Architect. Pruning trees shall be limited to addressing structural defects as shown in details; follow recommendations in "Structural Pruning: A Guide For The Green Industry" published by Urban Tree Foundation, Visalia CA.
- B. All pruning shall be performed by a person experienced in structural tree pruning.
- C. Except for plants specified as multi-stemmed or as otherwise instructed by the Landscape Architect, preserve or create a central leader.
- D. Pruning of large trees shall be done using pole pruners or if needed, from a ladder or hydraulic lift to gain access to the top of the tree. Do not climb in newly planted trees. Small trees can be structurally pruned by laying them over before planting. Pruning may also be performed at the nursery prior to shipping.
- E. Remove and replace excessively pruned or malformed stock resulting from improper pruning that occurred in the nursery or after.
- F. Pruning shall be done with clean, sharp tools.
- G. No tree paint or sealants shall be used.

3.17 MULCHING OF PLANTS

- A. Apply three inches of mulch before settlement, covering the entire planting bed area. Install no more than 1 inch of mulch over the top of the root balls of all plants. Taper to 2 inches when abutting pavement.
- B. For trees planted in lawn areas the mulch shall extend to a 5 foot radius around the tree or to the extent indicated on the plans.
- C. Lift all leaves, low hanging stems and other green portions of small plants out of the mulch if covered.

3.18 PLANTING BED FINISHING

- A. After planting, smooth out all grades between plants before mulching.
- B. Separate the edges of planting beds and lawn areas with a smooth, formed edge cut into the turf with the bed mulch level slightly lower, 1 and 2 inches, than the adjacent turf sod or as directed by the Landscape Architect. Bed edge lines shall be as depicted on the drawings.

3.19 WATERING

- A. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants from the point of installation until the date of Substantial Completion Acceptance. The Contractor shall adjust the automatic irrigation system, if available, and apply additional or adjust for less water using hoses as required.

- B. Hand water root balls of all plants to assure that the root balls have moisture above wilt point and below field capacity. Test the moisture content in each root ball and the soil outside the root ball to determine the water content.
- C. The Contractor shall install 25 gallon watering bag for each tree to be maintained and used for tree watering during the warranty period.
 - 1. The watering bags shall remain the property of the Owner at the completion of the work.

3.20 CLEAN-UP

- A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
 - 1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.
- B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Landscape Architect's seals are to remain on the trees and removed at the end of the warranty period.
- C. Make all repairs to grades, ruts, and damage by the plant installer to the work or other work at the site.
- D. Remove and dispose of all excess planting soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

3.21 PROTECTION DURING CONSTRUCTION

- A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers. Maintain protection during installation until Substantial Completion Acceptance. Treat, repair or replace damaged work immediately.
- B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including roots, trunk or branches of large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Landscape Architect shall determine when such cleaning, replacement or repair is satisfactory.

3.22 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION ACCEPTANCE

- A. During the project work period and prior to Substantial Completion Acceptance, the Contractor shall maintain all plants.
- B. Maintenance during the period prior to Substantial Completion Acceptance shall consist of pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, repairing and replacing of damaged tree wrap material, resetting plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings reasonably free of damaging insects and disease, and in healthy condition. The threshold for applying insecticides and herbicide shall follow established Integrated Pest Management (IPM) procedures. Mulch areas shall be kept reasonably free of weeds, grass.

3.23 SUBSTANTIAL COMPLETION ACCEPTANCE

- A. Upon written notice from the Contractor, the Landscape Architect shall review the work and make a determination if the work is substantially complete.
 - 1. Notification shall be at least 7 days prior to the date the contractor is requesting the review.
- B. The date of substantial completion of the planting shall be the date when the Landscape Architect accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.
- C. The Plant Warranty period begins at date of written notification of substantial completion from the Landscape Architect. The date of substantial completion may be different than the date of substantial completion for the other sections of the project.

3.24 MAINTENANCE DURING THE WARRANTY PERIOD BY OTHERS

- A. After Substantial Completion Acceptance, the Contractor shall make sufficient site visits to observe the Owner's maintenance and become aware of problems with the maintenance in time to request changes, until the date of End of Warranty Final Acceptance.
 - 1. Notify the Landscape Architect in writing if maintenance, including watering, is not sufficient to maintain plants in a healthy condition. Such notification must be made in a timely period so that the Landscape Architect may take corrective action.
 - a. Notification must define the maintenance needs and describe any corrective action required.
 - 2. In the event that the Contractor fails to visit the site and or notify, in writing, the Landscape Architect of maintenance needs, lack of maintenance shall not be used as grounds for voiding or modifying the provisions of the warranty.

3.25 MAINTENANCE DURING THE WARRANTY PERIOD BY THE PLANT INSTALLER

- A. During the warranty period, provide all maintenance for all plantings to keep the plants in a healthy state and the planting areas clean and neat.
- B. General requirements:
 - 1. All work shall be undertaken by trained planting crews under the supervision of a foreman with a minimum of 5 years experience supervising commercial plant maintenance crews.
 - 2. All chemical and fertilizer applications shall be made by licensed applicators for the type of chemicals to be used. All work and chemical use shall comply with all applicable local, provincial and federal requirements.
 - 3. Assure that hoses and watering equipment and other maintenance equipment does not block paths or be placed in a manner that may create tripping hazards. Use standard safety warning barriers and other procedures to maintain the site in a safe manner for visitors at all times.
 - 4. All workers shall wear required safety equipment and apparel appropriate for the tasks being undertaken.
 - 5. The Contractor shall not store maintenance equipment at the site at times when they are not in use unless authorized in writing by the Landscape Architect.
 - 6. Maintenance vehicles shall not park on the site including walks and lawn areas at any time without the Landscape Architect's written permission.
 - 7. Maintain a detailed log of all maintenance activities including types of tasks, date of task, types and quantities of materials and products used, watering times and amounts, and number of each crew. Periodically review the logs with the Landscape Architect, and submit a copy of the logs at the end of each year of the maintenance agreement.
 - 8. Meet with the Landscape Architect a minimum of three times a year to review the progress and discuss any changes that are needed in the maintenance program. At the end of the warranty period attend a hand over meeting to formally transfer the responsibilities of maintenance to the Landscape Architect. Provide all information on past maintenance activities and provide a list of critical tasks that will be needed over the next 12 months. Provide all maintenance logs and soil test data. Make the Contractor's supervisor available for a minimum of one year after the end of the warranty period to answer questions about past maintenance.
- C. Provide the following maintenance tasks:
 - 1. Watering; Provide all water required to keep soil within and around the root balls at optimum moisture content for plant growth.
 - a. Maintain all watering systems and equipment and keep them operational.
 - b. Monitor soil moisture to provide sufficient water. Check soil moisture and root ball moisture with a soil

moisture meter on a regular basis and record moisture readings. Do not over water.

2. Soil nutrient levels: Take a minimum of 4 soil samples from around the site in the spring and fall and have them tested by an accredited agricultural soil testing lab for chemical composition of plant required nutrients, pH, salt and % organic matter. Test results shall include laboratory recommendations for nutrient applications. Apply fertilizers at rates recommended by the soil test.
 - a. Make any other soil test and/or plant tissue test that may be indicated by plant conditions that may not be related to soil nutrient levels such as soil contaminated by other chemicals or lack of chemical uptake by the plant.
3. Plant pruning: Remove cross over branching, shorten or remove developing co dominant leaders, dead wood and winter-damaged branches. Unless directed by the Landscape Architect, do not shear plants or make heading cuts.
4. Restore plants: Reset any plants that have settled or are leaning as soon as the condition is noticed.
5. Guying and staking: Maintain plant guys in a taught position. Remove tree guys and staking after the first full growing season unless directed by Landscape Architect.
6. Weed control: Keep all beds free of weeds. Hand-remove all weeds and any plants that do not appear on the planting plan. Chemical weed control is permitted only with the approval of the Landscape Architect. Schedule weeding as needed but not less 12 times per year.
7. Trash removal: Remove all trash and debris from all planting beds and maintain the beds in a neat and tidy appearance. The number of trash and debris removal visits shall be no less than 12 times per year and may coincide with other maintenance visits.
8. Plant pest control: Maintain disease, insects and other pests at manageable levels. Manageable levels shall be defined as damage to plants that may be noticeable to a professional but not to the average person. Use least invasive methods to control plant disease and insect outbreaks.
 - a. The Landscape Architect must approve in advance the use of all chemical pesticide applications.
9. Plant replacement: Replace all plants that are defective as defined in the warranty provisions, as soon as the plant decline is obvious and in suitable weather and season for planting as outlined in above sections. Plants that become defective during the maintenance period shall be covered and replaced under the warranty provisions.
10. Mulch: Refresh mulch once a year to maintain complete coverage but do not over mulch. At no time shall the overall mulch thickness be greater than three inches. Do not apply mulch within 6 inches of the trunks or stems of any plants. Replacement mulch shall meet the requirements of the original approved material. Mulch shall be no more than one inch on top of the root ball surface.
11. Bed edging: Check and maintain edges between mulch and lawn areas in smooth neat lines as originally shown on the drawings.
12. Leaf, fruit and other plant debris removal: Remove fall leaf, spent flowers, fruit and plant part accumulations from beds and paved surfaces. Maintain all surface water drains free of debris. Debris removal shall be undertaken at each visit to weed or pick up trash in beds.
13. Damage from site use: Repair of damage by site visitors and events, beyond normal wear, are not part of this maintenance. The Landscape Architect may request that the Contractor repair damage beds or plantings for an additional cost. All additional work shall be approved in advance by the Landscape Architect.

3.26 END OF WARRANTY FINAL ACCEPTANCE / MAINTENANCE OBSERVATION

- A. At the end of the Warranty and Maintenance period the Landscape Architect shall observe the work and establish that all provisions of the contract are complete and the work is satisfactory.
 1. If the work is satisfactory, the maintenance period will end on the date of the final observation.
 2. If the work is deemed unsatisfactory, the maintenance period will continue at no additional expense to the Owner until the work has been completed, observed, and approved by the Landscape Architect.

- B. FAILURE TO PASS OBSERVATION: If the work fails to pass final observation, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Landscape Architect.

END OF SECTION 32 9300

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Requirements: Provide water distribution system, complete, as indicated on the Drawings or inferable therefrom and/or as specified in accordance with the Contract Documents.

1.2 SUBMITTALS

- A. Product Data: Submit copies of manufacturer's specifications and installation instructions for each material. Include certification or other data verifying compliance with required characteristics. Indicate by transmittal form that copy of each has been distributed to the Installer.
- ~~B.~~ Shop Drawings: Submit layout and shop drawings as required under Section Submittals. Include details of reinforced concrete structures.
- C. Test Reports: Submit certified Test Reports showing compliance of the following items in accordance with Section General Conditions.
 - 1. Laboratory test for bedding and trench stabilization materials.
 - 2. Concrete design mix.
 - 3. Compression tests.
 - 4. Water Test Reports: Submit results of water sample tests by State or local health authorities

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.
 - 3. The Contractor shall have one copy of the Standard Specifications at the job site.
 - 4. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and pavement sections do not apply to this document.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

- D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- E. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable-water-service piping.
 - 2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without owners representative written permission.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prevent damage to materials during loading, transportation, and unloading. Store equipment with moving parts off ground on platforms or skids.

1.6 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPE AND FITTINGS

- A. Ductile-Iron Pipe (NPS 4 to NPS 12): AWWA C151, Class 350 with cement mortar lining complying with AWWA C104 and 1 mil thick bituminous coating.

1. Fittings: Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts. Use corrosion resistant, high strength, low alloy steel, bolts and nuts where in contact with corrosive soil ASTM A 325.
 2. Fittings: Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern. Use corrosion resistant, high strength, low alloy steel, bolts and nuts where in contact with corrosive soil ASTM A 325.
 - a. Gaskets: AWWA C111, rubber.
- B. Copper Tube (NPS $\frac{3}{4}$ to NPS 3 $\frac{1}{2}$): ASTM B 88, Type K, water tube, annealed temper.
1. Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
- C. PVC, Schedule 40 (NPS $\frac{1}{8}$ to NPS 3 $\frac{1}{2}$): ASTM D 1785. Suitable for potable water distribution and manufactured in compliance with NSF Standards.
1. Fittings: PVC, Schedule 40 Socket Fittings: ASTM D 2466.
- D. PVC, AWWA Pipe (NPS 4 to NPS 12): AWWA C900, Class 305 DR 14, with bell-and-spigot or double-bell ends.
1. PVC to PVC Fittings: Push-on-Joint, PVC Fittings, ASTM 3139, with elastomeric gasket bell ends, conforming to ASTM D2122 for bell measurements.
 2. PVC to Metal Fittings, Valves, and Accessories: Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts. Use corrosion resistant, high strength, low alloy steel, bolts and nuts where in contact with corrosive soil ASTM A 325.

2.3 VALVES

- A. AWWA, UL/FM Cast-Iron, Gate Valves:
1. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509 and UL/F.M. approved, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - a. Minimum Working Pressure: 200 pounds per square inch gauge (psig).
 - b. End Connections: Flanged, push-on rubber gasketed, or mechanical joint, as required.
 - c. Interior Coating: Complying with AWWA C550.

2.4 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over valve, and approximately **five-inch** diameter barrel. Fabricate valve box cover to fit snugly to prevent displacement by traffic.
 - 1. Operating Wrenches: Steel tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- B. Vertical-Type Indicator Posts: UL 789, FM-approved, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve with tamperproof electrical supervisory switch for connection to the fire alarm control panel system.

2.5 VALVE APPLICATION

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
 - 1. Where specific valve types are not indicated, the following requirements apply:
 - a. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated, gate valves with valve box.
 - b. Underground Valves, NPS 4 and Larger, for Vertical-Type Indicator Posts: UL/FM, Cast-iron, nonrising-stem gate valves with indicator post.

2.6 CORROSION-PROTECTION ENCASUREMENT FOR PIPING

- A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.7 WATER METERS

- A. Water meter(s) indicated on drawings shall be installed by the local water purveyor for the area, unless noted otherwise.

2.8 BACKFLOW-PREVENTION DEVICES

- A. General: FM Approved, AWWA, UL Classified, Approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California.
 - 1. Working Pressure: 175 pounds per square inch (psi) minimum, unless otherwise indicated.
 - 2. Interior Components: Corrosion-resistant materials.
 - 3. Exterior Components: Assembly shall be provided with flanged connections, galvanized cast-iron or epoxy coated construction.

- B. Reduced-Pressure-Principle Backflow Preventers: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2, air-gap fitting located between two positive-seating check valves. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.
- C. Reduced-Pressure-Detector Assembly Backflow Preventers: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2, air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.
- D. Double-Check-Valve Backflow Prevention Assemblies: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.
- E. Double-Check-Detector Assembly Backflow Preventers: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.

2.9 FIRE HYDRANTS

- A. Before procurement, verify approval has been issued by the Fire Department having jurisdiction.
- B. Wet-Barrel Fire Hydrants: AWWA C503 or UL 312, one NPS 4 and two NPS 2-1/2 outlets, NPS 6 threaded or flanged inlet, and base section with NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have 150 pounds per square inch gauge (psig) minimum working-pressure design.
 - 1. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - 2. Operating and Cap Nuts: Pentagon, one-and-one-half inches point to flat.
 - 3. Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.
- C. Combined length of bury and extension shall be as indicated. Where not indicated, install top of hydrant flange three inches above finished surface.
- D. Exterior Finish: "O.S.H.A. safety yellow" Ameritone 719 or approved equal after receiving a prime coat.

2.10 FIRE DEPARTMENT CONNECTIONS

- A. Exposed, Freestanding, Fire Department Connections: UL 405, cast-bronze body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate, and all appropriate check valves per NFPA 24.
 - 1. Escutcheon Plate Marking: "AUTO SPKR."

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examination: Examine substrates, adjoining construction and conditions under which Work is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected

3.2 PREPARATION

- A. Field Measurements: Verify dimensions before proceeding with Work. Obtain field measurements for work required to be accurately fitted to other construction. Be responsible for accuracy of such measurements and precise fitting and assembly of finished work.

3.3 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 - 3. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
 - 4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
 - 5. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.4 PIPING INSTALLATION

- A. Project site water lines shall terminate approximately five feet from buildings, unless otherwise indicated on Drawings. Install temporary cap or plug terminals for future connection to building.
- B. Bury piping with depth of cover over top at least 36 inches, unless otherwise indicated.
- C. Comply with NFPA 24 for fire-service-main piping materials and installation.

- D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- E. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- F. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.
- G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports for all lines NPS 3 or greater.
- H. Water Main Connection: Arrange and pay for tap in the water main, water meter, and all associated fees from the water purveyor.

3.5 CLEARANCE OF WATER LINE

- A. Building or Structure: Two feet minimum horizontal separation.
- B. Sewer crossing:
 - 1. Typical Conditions: Lay water mains over sanitary sewers to provide vertical separation minimum three feet.
 - 2. Unusual Conditions: If above separation cannot be met, for sewers less than three feet below the water pipe, use the following:
 - a. Install water line with all joints located at least four feet from each side of the sewer pipe.
 - b. Sewer pipe encased in six inches concrete around pipe, and extend four feet either side of water main.
- C. Parallel to Sewer Line: Water line shall not be installed in a common trench with the building sanitary sewer unless both of the following requirements are met:
 - 1. The bottom of the water pipe, at all points, shall be at least 12 inches above the top of the sewer.
 - 2. The water pipe shall be placed on a solid shelf excavated at one side of the common trench with a minimum clear horizontal distance of at least 12 inches from the sewer.

3.6 ANCHORAGE INSTALLATION

- A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches for all lines NPS 3 or greater. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 - 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 - 3. Fire-Service-Main Piping: According to NFPA 24.
 - 4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

- A. Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. Vertical-Type Indicator Post Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.

3.8 BACKFLOW-PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers with relief drain in vault or other space subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support three-inch and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.
- E. Access and clearance shall be provided for the required testing, maintenance and repair. Access and clearance shall require a minimum of one foot between the lowest portion of the assembly and grade or platform.
- F. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.

3.9 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

3.10 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install fire department connections of types and features indicated.
- B. Install ball drip valves at each check valve for fire department connection to mains.

3.11 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. Refer to Division 31 Section "Earth Moving" for tape specifications.

3.12 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: The piping shall be subjected for a minimum of two hours to a pressure of one and one-half times the working pressure, but in no case less than 150 pounds per square inch (psi). Examine all exposed pipe, joints, fittings and accessories during the test period. Replace or repair defective portions of the system, and repeat tests until results are satisfactory.
 - 1. Allowable leakage shall be as specified in AWWA C-600, Table 3.
- C. Prepare reports of testing activities.

3.13 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 parts per million (ppm) of chlorine; isolate and allow to stand for 24 hours, or
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 parts per million (ppm) of chlorine; isolate and allow to stand for three hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 33 11 00

SECTION 33 31 00

SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:
 - 1. Cleanouts.
 - 2. Precast concrete manholes.

1.2 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

- A. Manufacturer's product data for pipe and fittings.
- B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.4 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Shielded, Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.5 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 1. Diameter: Forty-eight inches, unless otherwise indicated.
 - 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 - 3. Base Section: Six-inch minimum thickness for floor slab and four-inch (100-mm) minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.
 - 4. Riser Sections: Four-inch minimum thickness, and of length to provide depth indicated.
 - 5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 - 6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 - 7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 - 8. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, one-half-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 - 9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

10. Grade Rings: Reinforced concrete rings, six- to nine-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by seven- to nine-inch riser with four-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording "SANITARY SEWER."
 - a. Material: ASTM A 536, Grade 60-40-18 ductile iron or ASTM A 48/A 48M, Class 35 gray iron, unless otherwise indicated.

2.6 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 1. Top-Loading Classification: **[Light] [Medium] [Heavy] [and] [Extra-heavy]** duty.
 2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.7 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 3,250 pounds per square inch (psi) minimum unless otherwise noted, Aggregate Gradation "C" per SSPWC 201-1.3.2 and 0.45 maximum water/cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: Two percent through manhole unless otherwise noted.
 2. Benches: Concrete, sloped to drain into channel.

- a. Slope: Four percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
 - 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - a. Shielded flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction if shown on plan, otherwise use fittings. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of one percent, unless otherwise indicated.
 - 2. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - 3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
- F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.2 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 - 2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
 - 3. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
 - 4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
 - 5. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

3.3 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops three inches above finished surface elsewhere, unless otherwise indicated.

3.4 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 15 Section "Sanitary Waste and Vent Piping."
- B. Make connections to existing piping and underground manholes.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus six-inch overlap, with not less than six inches of concrete with 28-day compressive strength of 3,250 pounds per square inch (psi).

3.5 FIELD QUALITY CONTROL

- A. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
 - 4. Submit separate report for each test.

5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Allowable leakage is maximum of 50 gallons/inch of nominal pipe size per mile of pipe, during 24-hour period.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 - f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 pounds per square inch gauge (psig).
6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- B. Leaks and loss in test pressure constitute defects that must be repaired.
- C. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

END OF SECTION 33 31 00

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage pipe and drainage structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

- A. Product Data: For each type of product installed.
- B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) HDPE PIPE AND FITTINGS

- A. HDPE Drainage Pipe and Fittings, NPS 4 to NPS 10: AASHTO M252, Type S, with bell-and-spigot ends. Gasketed joints shall be soil-tight with ASTM F 477, elastometric seals.
- B. HDPE Drainage Pipe and Fittings, NPS 12 to NPS 60: AASHTO M294, Type S, or ASTM F2306 with bell-and-spigot ends. Gasketed joints shall be soil-tight with ASTM F 477, elastometric seal.

2.4 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.
- B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.6 CLEANOUTS

- A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.7 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 1. Diameter: Forty-eight inches minimum, unless otherwise indicated.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: Six-inch minimum thickness for floor slab and four-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: Four-inch minimum thickness, and of length to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990 bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, one-half-inch steel reinforcing rods encased in ASTM D 4101, PP wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, six- to nine-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by seven- to nine-inch riser with four-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording "STORM DRAIN."
 - a. Material: ASTM A 536, Grade 60-40-18 ductile iron or ASTM A 48, Class 35 gray iron, unless otherwise indicated.

2.8 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.
5. Pipe Collars, Ballast and Pipe Supports, Precast Manhole Components, Catch Basins, and Sidewalk Culverts: Portland cement design mix, 3,250 pounds per square inch (psi) minimum unless otherwise noted, Aggregate Gradation "C" per SSPWC 201-1.3.2, and with 0.45 maximum water-cementitious materials ratio.
 - a. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - b. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.9 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: Six-inch minimum thickness for floor slab and four-inch minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.
 2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.
 3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for H-20 (heavy traffic) structural loading unless otherwise indicated. Include 24-inch ID by seven- to nine-inch riser with four-inch minimum width flange, and 26-inch-diameter flat grate with small square or short-slotted drainage openings.
1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - a. Shielded flexible couplings for same or minor difference OD pipes.
 - b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.2 PIPING INSTALLATION

- A. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- B. Install manholes for changes in direction if shown on plan, otherwise use fittings. Use fittings for branch connections unless direct tap into existing storm drain is indicated.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of one percent, unless otherwise indicated.
 2. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

- E. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 - 2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
 - 3. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
 - 4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops three inches above finished surface elsewhere, unless otherwise indicated.

3.5 CATCH BASIN INSTALLATION

- A. Set frames and grates to elevations indicated.

3.6 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."
- B. Make connections to existing piping and underground manholes.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus six-inch overlap, with not less than six inches of concrete with 28-day compressive strength of 3,250 pounds per square inch (psi).

3.7 LOW IMPACT DEVELOPMENT STORM WATER MITIGATION SYSTEMS INSTALLATION

- A. All storm water mitigation systems proposed as a part of this project, and as approved by the local jurisdiction, are to be inspected by the Civil Engineer of Record during the installation process, after installation is complete, and prior to obtaining a certificate of occupancy.

1. Notify the Civil Engineer of Record at least 24-48 hours prior to the following (minimum) stages, in addition to those noted above, for inspection purposes:
 - a. Excavation for system installation.
 - b. Placement of gravel fills, system liners, piping, inlet and overflow piping, soil backfill, and planting where required.

3.8 FIELD QUALITY CONTROL

- A. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Hydrostatic Tests: Test sewers according to requirements of authorities having jurisdiction and the following:
 - a. Allowable leakage is maximum of 50 gallons/inch of nominal pipe size per mile of pipe, during 24-hour period.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 6. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 pounds per square inch gauge (psig).
 7. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- B. Leaks and loss in test pressure constitute defects that must be repaired.
- C. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

END OF SECTION 33 41 00

SECTION 33 46 00

SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes subdrainage systems for foundations, underslab areas, retaining walls, and other subdrainage systems.

1.2 SUBMITTALS

- A. Product Data: For perforated pipe, fitting and drainage panel.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated plastic pipe shall be either smooth-wall polyvinyl chloride plastic pipe, corrugated polyvinyl chloride plastic pipe with a smooth interior surface, or corrugated polyethylene plastic tubing.
 - 1. Smooth-wall polyvinyl chloride plastic pipe shall conform to the requirements in AASHTO Designation: M 278.
 - 2. Corrugated polyvinyl chloride plastic pipe with a smooth interior surface shall conform to the material and structural requirements in AASHTO Designation: M 278. The pipe shall have perforations located in the bottom half of the pipe, and the perforations shall consist of slots meeting the size and opening area requirements in AASHTO Designation: M 252. The inside diameter and diameter tolerances shall conform to the requirements of either AASHTO Designation: M 252 or M 278.
 - 3. Corrugated polyethylene plastic tubing shall conform to the requirements in AASHTO Designation: M 252 or M 294.

2.2 PERFORATIONS

- A. Perforations per ASTM F 758, section 7.2.4., and Table 5.
 - 1. NPS 4: four rows of perforations.
 - 2. NPS 6 and 8: Four rows of perforations
 - 3. NPS 10 and larger: Six rows of perforations.

2.3 FITTINGS

- A. Polyvinyl chloride pipe shall be connected with belled ends, or with sleeve-type or stop-type couplings conforming to the requirements in AASHTO Designation: M 278. Polyethylene tubing shall be connected with snap-on, screw-on, or wrap-around fittings and couplings conforming to the requirements of AASHTO Designation: M 252 or M 294. Solvent cementing of joints will not be required.

2.4 SPECIAL PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.
 - 1. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant metal tension band and tightening mechanism on each end.
 - 2. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant metal tension band and tightening mechanism on each end.

2.5 DRAINAGE PANELS

- A. Molded-Sheet Drainage Panels: Prefabricated geocomposite, 36 to 60 inches wide with drainage core faced with geotextile filter fabric.
 - 1. Manufacturers:
 - a. American Wick Drain Corporation – Amerdrain.
 - b. Cosella-Dorken.
 - c. CCW – MiraDrain.
 - d. Eljen Corp.
 - e. Greenstreak, Inc.
 - f. JDR Enterprises, Inc.
 - g. LINQ Industrial Fabrics, Inc.
 - h. Midwest Diversified Technologies Incorporated.
 - i. TC Mirafi.
 - j. Any equivalent manufacturer.
 - 2. Prefabricated Drainage Core: Three-dimensional, nonbiodegradable, molded PP or PS. Select prefabricated drainage core recommended by the manufacturer for the type of application specified elsewhere in the contract documents.
 - a. Minimum Compressive Strength: 10,000-pound force (lbf)/square foot according to ASTM D 1621.
 - b. Minimum In-Plane Flow Rate: Ten gallons per minute (gpm)/foot according to ASTM D-4716.

3. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties:
 - a. Grab Elongation: 60 percent maximum according to ASTM D-4632.
 - b. Apparent Opening Size: No. 70 sieve, minimum according to ASTM D-4751.
 - c. Water Flow Rate: 165 gpm/square foot according to ASTM D-4491.

2.6 SOIL MATERIALS

- A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

2.7 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gallons per minute (gpm)/square foot when tested according to ASTM D 4491.
 1. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.
 2. Style(s): Flat and sock.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

- A. Underground Subdrainage Piping:
 1. Perforated PE pipe and fittings, couplings, and coupled joints.
 2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.
- B. Underslab Subdrainage Piping:
 1. Perforated PE pipe and fittings, couplings, and coupled joints.
 2. Perforated PVC sewer pipe and fittings and loose, bell-and-spigot joints.
- C. Header Piping:
 1. PE drainage tubing and fittings, couplings, and coupled joints.
 2. PVC sewer pipe and fittings, couplings, and coupled joints.

3.3 FOUNDATION DRAINAGE INSTALLATION

- A. Install vertical drainage panels per manufacturer's installation instruction and details or as follows:
 - 1. Coordinate placement with other drainage materials.
 - 2. Separate four inches of fabric at beginning of roll and cut away four inches of core. Wrap fabric around end of remaining core.
 - 3. Attach panel to wall at horizontal mark and at beginning of pipe. Place core side of panel against wall. Use concrete nails with washers through product cylinders to attach panel to wall. Place nails from two to six inches below top of panel, approximately 48 inches apart. Construction adhesives, metal stickpins, or double-sided tape may be used instead of nails. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
 - 4. If additional panels are required on same row, cut away four inches of installed panel core, install new panel against installed panel, and overlap new panel with installed panel fabric.
 - 5. If additional rows of panels are required, overlap lower panel with four inches of fabric.
 - 6. Cut panel as necessary to keep top 12 inches below finish grade.
 - 7. For inside corners, bend panel. For outside corners, cut core to provide three inches for overlap.
- B. Place initial backfill material over compacted drainage course. Place material in loose-depth layers not exceeding six inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.4 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
 - 2. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
 - 3. Lay perforated pipe with perforations down.
 - 4. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install PE piping according to ASTM D 2321.
- D. Install PVC piping according to ASTM D 2321.

3.5 PIPE JOINT CONSTRUCTION

- A. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."
- B. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.
- C. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
- D. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.
- E. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties..
- B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.
- C. Where required, connect low elevations of foundation subdrainage to storm water sump pumps.

3.7 FIELD QUALITY CONTROL.

- A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.8 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 46 00

SECTION 48 14 00

SOLAR ENERGY ELECTRICAL POWER GENERATION EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. The solar photovoltaic ["PV"] systems described in this document shall be of the grid-connected type. PV systems shall feed AC power into the local services when solar energy is available and shall immediately disconnect from the grid upon loss of grid power to the service as per IEEE and local utility regulations.
- B. The contractor shall provide, install, commission, and test the new grid-tied complete and operational photovoltaic (PV) system as described herein.
- C. The system shall comply with these specifications, the construction document drawings, all applicable codes, and local authorities. System shall comply with all policies and standards required by the electric utility having jurisdiction and all applicable incentive program guidelines. The equipment includes, but is not limited to, PV modules, inverters, disconnects, wire, conduit, junction boxes, and mounting hardware.
- D. Any substituted equipment installed without the approval of the engineer and owner shall be removed and replaced with acceptable material without cost to the owner. Contractor is responsible for providing any additional work or adjustments caused by substituted equipment needed for compliance or proper operation at no cost to the owner.
- E. The work includes furnishing and/or paying for all materials, fees, permits not covered in the general building permit, labor, tools, equipment, transportation and services required for a complete installation.
- F. Contractor shall provide access to equipment for maintenance and service as required by the manufacturer's instructions and/or applicable codes.
- G. The photovoltaic construction document drawings show equipment locations and sizes for the PV systems. The contractor must obtain approval before altering any of the criteria set forth in these specifications or the drawings.
- H. All DC conductors shall be sized such that there is a maximum of 2% voltage drop measured at the short circuit current rating of that circuit, over the entire length of each circuit from PV module to inverter, and back to PV module. All AC conductors shall be sized for a maximum of 1.5% voltage drop measured at the continuous AC current rating of the inverter between the inverter and the point of interconnection with the grid.
- I. Each series string of PV modules shall be independently protected by an isolation fuse or breaker before it is connected in parallel with the other string on that PV output circuit. The current rating of this isolation fuse or breaker shall be less than the de-rated ampacity of the wiring that it is protecting and greater than 1.56 times the short circuit current rating of the PV modules in that PV source circuit. All other conductors and overcurrent devices shall be sized per the requirements of CEC Article 690.8.

- J. The contractor shall coordinate with the architect and/or electrical engineer on the locations and appearance of all exposed equipment, including but not limited to, PV modules, conduit, inverters, and wireways. All locations must be approved by the architect and/or electrical engineer and architect prior to installation.
- K. The contractor shall visit the site to ascertain the nature and location of the work and verify all existing conditions that could affect the work or the cost thereof, including but not limited to conditions to be encountered in the installation of all new equipment, arrays, devices, feeders, etc. Exact installation method and requirements shall be verified and determined prior to bid date.
- L. Given that the PV system installation requires work to be performed by various subcontractors, the contractor shall provide coordination with all trades needed for a complete installation including all required electrical services, building integration elements, and equipment clearances required for a complete and operable system.
- M. PV system shall be guaranteed for a period of ten years from the date of acceptance by the architect and/or electrical engineer.

1.02 RELATED DOCUMENTS

- A. The contractor shall comply with all requirements of Division 26 - Electrical in this specification book and with the conditions of the contract. The contractor shall comply with the general conditions of this specification for requirements for submittals, substitutions, testing, training, warranty, damage responsibility, permits, fees, clean-up, and all other general items, in addition to any specific requirements of this section.
- B. Work shall comply with all applicable codes, standards, local authorities, utilities and manufacturer's instructions/recommendations.
- C. The contractor shall comply with the PV system construction document drawings, including all notes and specifications.
- D. PV system layout is conceptual only. Contractor shall be responsible for complete set of PV system construction documents based on conceptual plans and specifications to be submitted separately to building department for approval.
- E. These PV system drawings are diagrammatic and represent the intent of equipment, devices, etc. to be connected and the circuits to which they are to be connected to. Contractor shall install all conduit, junction boxes, etc. as required for a complete and operational system.
- F. The contractor shall examine the architectural and electrical drawings to determine requirements.
- G. All work shall comply with the building department, health department, fire department, and all other local authorities having jurisdiction.
- H. All work, including equipment, materials, and installation shall conform to 2025 California Administrative Code, Title 24, Building Standards (CAC Title 24); to 2025 California Administrative Code, Title 8, Chapter 4, Division of Industrial Safety (DIS); 2025 California Electrical Code (CEC); and 2025 California Fire Code (CFC.)

- I. The minimum requirement of the more stringent code or standard shall govern where more than one code or standard is applicable to any component or condition.
- J. The contractor shall obtain and comply with manufacturer specifications, instructions and recommendations for all equipment and materials.
- K. The contractor shall immediately notify the architect and/or electrical engineer of any provision in the specifications that is contrary to the applicable codes.
- L. Any work performed by the contractor at variance with the applicable codes and without prior written approval of the architect and/or electrical engineer shall be corrected as required without additional cost to the owner.

1.03 REFERENCES

- A. California Electrical Code (CEC), based on the National Electrical Code with California amendments
 - 1. Article 690 – Solar photovoltaic systems.
 - 2. Article 705 – Interconnected electric power production sources.
 - 3. Article 250 – Grounding.
 - 4. Article 110 – Requirements for electrical installations.
- B. IEEE standards
 - 1. IEEE 1262 – PV module qualification for performance and reliability.
 - 2. IEEE 929 – Inverter interconnection standards.
- C. Underwriter's Laboratories (UL) standards
 - 1. UL1703, UL61730-1, UL61730-2 – Flat plate PV modules and panels.
 - 2. UL1741 – Static inverters for use in photovoltaic power systems.
 - 3. UL2703 – PV mounting systems.
- D. National Fire Protection Association (NFPA) standards
- E. Occupational Safety and Health Administration (OSHA) standards
 - 1. 1926 Subpart M – Fall protection.

1.04 UTILITY APPROVAL

- A. Contractor shall submit interconnection application with local utility provider.
- B. Upon receipt of final building inspection approval, contractor shall immediately send a copy of the signed-off building permit to architect for scheduling of the final inspection with the local utility provider. Contractor shall be present for the final inspection.

1.06 CONTRACTOR QUALIFICATIONS

- A. The PV systems described herein shall be built by a licensed (C-46) solar contractor or a licensed (C-10) electrical contractor.
- B. PV contractor shall be a NABCEP certified PV installer.

1.07 WARRANTY

- A. The contractor shall warrant that the work conforms to contract requirements and is free of any defects.
- B. The contractor shall provide a minimum of a full ten-year warranty against breakdown or degradation of electrical output. The warranty must cover all components of the PV generating system against breakdown or degradation in electrical output of more than 10% of their originally rated electrical output. The warranty shall cover the full parts and labor cost of repair or replacement of defective components or systems.
- C. Any defective materials or inferior workmanship during installation and/or the warranty period shall be corrected immediately to the entire satisfaction of the architect and without additional cost to the owner.

1.08 SUBMITTALS

- A. Contractor shall provide shop drawings depicting PV module layout. Shop drawings shall detail the proposed PV module layout scheme, stringing plan, voltage drop calculations and structural load calculations.
- B. Contractor shall provide shop drawings showing wall elevations for all inverter locations. Elevations shall include location information for all inverters, disconnects, conduits, and gutters.
- C. Contractor shall provide sun path shade measurements and a proposed PV array stringing plan for each array location once the structure has been built, but prior to installation of PV modules. Engineering approval is required on final PV module string wiring plan.
- D. Contractor shall provide information on all substituted PV equipment, electrical service equipment, distribution equipment and panelboards, or other items specifically indicated.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide equipment as specified on the drawings, or equipment of equal quality and performance. Provide all accessories needed for complete, secure, operational grid-tied PV systems.
- B. PV contractor shall provide and install all equipment shown on these drawings except work labeled "E.C." or "by others". Electrical contractor shall provide and install all work labeled "E.C.".
- C. All materials, fixtures, and equipment required for the work shall be new and shall be furnished, delivered, erected, connected and finished in every detail, and shall be selected and arranged as to fit properly into the building spaces.
- D. All equipment shall be listed and labeled per recognized electrical testing laboratory and installed per the listing requirements and the manufacturer's instructions.
- E. All equipment shall be properly grounded per the requirements of CEC Article 250.
- F. All outdoor equipment shall be minimum NEMA 3R.
- G. All connectors and couplers shall be of set screw type unless otherwise noted when run inside a building. All exterior connectors and couplers shall be rain tight.
- H. Any conduit runs shown are diagrammatic. Exact locations and conduit runs to be determined in the field prior to bid. Subcontractor shall provide documentation and legible drawings of all conduit placement deviating from plans.
- I. All exposed conduit shall be EMT or rigid metal conduit as per the requirements of Division 26 Specifications Section 260533, "Raceway and Boxes for Electrical Systems."
- J. All fused disconnect switches to be provided with rejection type fuse holders and viewing window for visible verification of blade separation.
- K. Current-limiting fuses within PV systems are likely to be energized from both directions and shall comply with CEC 705.20 and CEC 240.40.
- L. All installed junction, pull and outlet boxes located behind modules or panels shall be accessible directly or by displacement of a module(s) or panel(s) secured by removable fasteners.
- M. Each side of a power transformer shall be considered as primary and protected in accordance with CEC 450.3.
- N. If a BESS system is integrated as part of the PV system, equipment including but not limited to inverters, disconnects, panelboards etc. may be shared between the two systems where indicated by PV and BESS system drawings.

2.02 PV MODULES

- A. PV modules shall be IEEE 1262 compliant, and listed to UL Standard 1703 or UL 61730-1 & UL 61730-1.
- B. PV modules shall be of a type listed as rated for a Class 'A' fire rated roof. PV contractor shall verify with GC on roof/module type compatibility.
- C. PV modules shall be listed to UL standard 2703 with the specified PV rail mount system.
- D. Each solar photovoltaic module has a positive and negative MC-4 "sunlight resistant" quick connector. Contractor shall verify compatible extension wires prior to installation.
- E. PV modules shall be JA Solar JAM72D30-540/MB or approved equal.

2.03 INVERTERS

- A. All inverters shall be IEEE 929 compliant, listed to UL Standard 1741, and inspected by local electric utility provider before commissioning, testing, and operation of the system.
- B. Inverter shall be equipped with integrated GFDI for ground fault protection.
- C. Inverter shall be of transformerless (TL) type.
- D. All inverters shall be SolarEdge SE30KUS, SolarEdge SE40KUS, or approved equal.

2.04 PV RAIL MOUNT SYSTEM

- A. PV rail mount system shall be listed to UL Standard 2703 with the specified PV module.
- B. All PV rail mount shall be IronRidge XR1000 or approved equal.

PART 3 – EXECUTION

3.01 GENERAL

- A. All electrical work shall be in accordance with the 2025 California Electrical Code, local building department regulations, and local fire district regulations.
- B. PV plans shall be approved by the fire department as required by local AHJ requirements prior to final approval.
- C. All circuits connected to more than one source shall have overcurrent devices located so as to provide overcurrent protection from all sources per CEC 690.9 (A).

- D. Photovoltaic systems shall be interconnected with the utility grid, and shall backfeed the distribution system on site per the requirements of CEC Art. 705.12. All plug-in type backfed breakers shall be identified as such. The backfed power source must be listed and identified as interactive, else the breaker shall be secured in place by an additional fastener per the requirements of CEC 408.36 (D.)
- E. If equipment cannot be properly concealed, notify architect and/or electrical engineer. Any patching and cutting done as a result of error or neglect on the part of the contractor shall be done at the expense of the contractor.
- F. Attachments: support all work adequately and per code. All equipment shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature.
- G. Shoring: the contractor shall provide all permanent and temporary shoring, anchoring and bracing required by the nature of this work in order to make all parts absolutely stable and rigid, even when such shoring, anchoring and bracing are not explicitly called for.
- H. Labeling: labels per CEC Article 690, Part VI "Marking", CEC 705.10, and CEC 705.12 (C) shall be provided. The PV backfeed sub-panel and all breakers contained in it, as well as the PV system disconnect, shall be clearly labeled.
- I. Contractor shall keep work areas in a clean and safe condition. Remove all equipment, tools, vehicles, rubbish, waste and debris from the site upon completion of the job. The contractor shall pay all fees for recycling and disposal.
- J. Fall arrest protection per OSHA 1926 Subpart M shall be provided for all roof work.
- K. Penetrations of all fire rated walls or ceilings shall be fire rated in accordance with all local, state, and national codes.

3.02 POWER MAXIMIZATION

- A. Approximate series string groupings are indicated on the drawings. Contractor to determine exact series string groupings given the shading constraints of final structure and surroundings based on industry best practices.
- B. Contractor shall not wire PV arrays without final approval from the engineer on series string groupings.

3.03 CONDUCTORS

- A. All conductors shall be copper unless otherwise noted.
- B. All proposed conductors rated for 90°C, however ratings shall be assumed to be 75°C for all building feeders and therefore terminations prior to connection. Intermediate junction box may be required to change from 90°C to 75°C.
- C. Wiring material shall be copper and 90°C rated, suitable for sun exposure and suitable for wet locations. Field applied coatings are not acceptable.

- D. All wire run across roof to combiner boxes shall be of insulation type THWN-2 or USE-2. PV wires that are UL listed for use in PV applications are also permitted to be used in source circuits.
- E. All homerun wire runs of length greater than 20' shall originate from a NEMA 3R minimum rated junction box with THWN-2 conductors in conduit.
- F. Single-conductor cable type USE-2 and PV wires that are UL listed for use in PV applications are permitted to be used in the source circuits.
- G. All inter-module series connections shall be tie strapped with black UV resistant tie straps and/or approved prefabricated wire routing tray, so as to best conceal and protect inter-module homerun wiring. All wiring to be concealed under array and/or in conduit.
- H. All homerun wire runs between rows shall be made in conduit with strain relief fitting or wire compression clamp and conduit putty to act as barrier to moisture.

3.04 CONDUITS & RACEWAYS

- A. Rigid galvanized steel conduit shall be used in all areas exposed to weather or physical damage.
- B. Flexible metallic conduit shall only be used in areas as permitted by local code authority. Use Seal-Tite in areas exposed to weather.
- C. Where electrical metallic tubing (EMT) is utilized, compression type fittings are to be used.
- D. All conduit below grade shall be electrical PVC. PVC conduit shall be used with code sized ground. Conduit risers and stubs above grade shall be IMC with half-lapped tape covering or PVC coating.
- E. All conduits exposed in electrical pads or rooms shall be of type specified in the single line diagram and/or conductor schedule.
- F. Conduits penetrating fire rated areas shall be sealed, inside and outside of conduit, with approved fire stop material to maintain the same fire ratings as original.
- G. Conduit shall be secured at 10 ft minimum intervals.
- H. Conduit for roof mounted equipment may be routed below the roof surface within the building.

3.05 GROUNDING

- A. All equipment shall be properly grounded per the requirements of CEC Article 250.
- B. All services supplying the building shall have the same grounding electrode system.
- C. Ground bond conductor shall not be spliced.
- D. Grounding system used is a combined AC/DC system.
- E. As PV inverter is transformerless, a dedicated grounding electrode conductor is not required for PV source. Equipment grounding conductor shall be use as grounding electrode conductor per the exception in CEC 250.121 (A.)
- F. Use equal or approved "lay in lug" (ILSCO, UL467 rated, high strength copper alloy with SS screw as necessary) for grounding and bonding.
- G. PV rail and mounting system must be listed with the PV module to UL Standard 2703 to utilize Webb integrated bonding between PV module and mounting rail system.
- H. When integrated Webb grounding is not available, DC equipment ground shall be minimum 6 AWG bare solid copper wire to bond module frames and racking.
- I. Contractor shall confirm building and panel grounding (existing or new where applicable) prior to installation.

3.06 TESTING & INSPECTIONS

- A. The contractor shall notify the architect and/or electrical engineer a minimum of 5 days before closing in of to-be-concealed work so that an owner's representative may inspect the work.
- B. Before starting or operating the system, contractor shall check continuity of all conductors and grounding conductors to verify that there are no faults and that all equipment has been properly installed. Check factory instructions to see that installations have been made accordingly. Check equipment for any damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment or replace with new equipment of like kind.
- C. Before starting or operating the system, contractor shall obtain a final inspection approval from the building department and a final inspection approval from local utility provider. Contractor shall be present on site for both of these inspections.
- D. Once the building department and local utility provider approvals have been received, contractor shall test all equipment to ensure specified capacity and performance of the system. The contractor shall notify the architect and/or electrical engineer a minimum of 5 days prior to the test so that an owner's representative may witness the test. Contractor shall replace or revise any equipment, systems, or work found deficient during the test.
- E. Contractor shall make final adjustments to all inverters so that they will be placed in an acceptable operating condition.

3.07 COMMISSIONING

- A. Contractor shall provide complete commissioning of the PV systems.
- B. Verify that all equipment is installed and connected according to the requirements of the PV drawings, specifications, and manufacturer's written instructions.
- C. Perform startup checks for all equipment per manufacturer's written instructions.
- D. PV module test: during the daytime while the sun is shining on the PV array, measure the output current of each sub-array.
- E. Program and adjust all inverters in accordance with the specified system operation and the manufacturer's recommendations.
- F. Replace all damaged and/or malfunctioning equipment.
- G. Since PV modules are energized whenever they are exposed to light, PV contractor shall disable the array during installation and service by short circuiting, open circuiting, or covering the array with an opaque covering.

3.08 DEMONSTRATION

- A. Provide a complete set of operation documentation, a walk-through of system operation, and training for service for the PV system.
- B. Train owners' maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
- C. Schedule training with contracting officer with at least seven days' advance notice.
- D. Any and all documentation necessary for the safe operation & maintenance of the system shall be provided by PV contractor and stored on-site.

END OF SECTION

SECTION 48 17 13

ELECTRICAL POWER GENERATION BATTERIES

PART 1 - GENERAL

1.01 SUMMARY

- A. The battery-based energy storage system ["BESS"] systems described in this document shall be of the grid-connected type. If PV system is present, BESS shall charge from excess unused PV production. BESS system shall immediately disconnect from the grid upon loss of grid power to the service as per IEEE and local utility regulations.
- B. The contractor shall provide, install, commission, and test the new grid-tied complete and operational BESS as described herein.
- C. The system shall comply with these specifications, the construction document drawings, all codes, and local authorities. System shall comply with all policies and standards required by the electric utility having jurisdiction and all applicable incentive program guidelines. The equipment includes, but is not limited to, battery modules/cabinets, inverters, disconnects, wire, conduit, junction boxes, and mounting hardware.
- D. Any substituted equipment installed without the approval of the engineer and owner shall be removed and replaced with acceptable material without cost to the owner. Contractor is responsible for providing any additional work or adjustments caused by substituted equipment needed for compliance or proper operation at no cost to the owner.
- E. The work includes furnishing and/or paying for all materials, fees, permits not covered in the general building permit, labor, tools, equipment, transportation and services required for a complete installation.
- F. Contractor shall provide access to equipment for maintenance and service as required by the manufacturer's instructions and/or applicable codes.
- G. The BESS construction document drawings show equipment locations and sizes for the BESS. The contractor must obtain approval before altering any of the criteria set forth in these specifications or the drawings.
- H. All DC conductors shall be sized such that there is a maximum of 2% voltage drop measured at the short circuit current rating of that circuit, over the entire length of each circuit from BESS unit to inverter and back to BESS unit. All AC conductors shall be sized for a maximum of 1.5% voltage drop measured at the continuous ac current rating of the inverter between the inverter and the point of interconnection with the grid.
- I. Each series string of BESS modules shall be independently protected by an isolation fuse or breaker before it is connected in parallel with the other strings on that BESS output circuit. The current rating of this isolation fuse or breaker shall be less than the de-rated ampacity of the wiring that it is

protecting and greater than 1.56 times the short circuit current rating of the BESS modules in that BESS source circuit. All other conductors and overcurrent devices shall be sized per the requirements of CEC 706.30.

- J. The contractor shall coordinate with the architect and/or electrical engineer on the locations and appearance of all exposed equipment, including but not limited to, battery modules/cabinets, conduit, inverters, and wireways. All locations must be approved by the architect and/or electrical engineer and architect prior to installation.
- K. The contractor shall visit the site to ascertain the nature and location of the work and verify all existing conditions that could affect the work or the cost thereof, including but not limited to conditions to be encountered in the installation of all new equipment, BESS cabinets, devices, feeders, etc. Exact installation method and requirements shall be verified and determined prior to bid date.
- L. Given that the BESS system installation requires work to be performed by various subcontractors, the contractor shall provide coordination with all trades needed for a complete installation including all required electrical services, building integration elements, and clearances required for a complete and operable system.
- M. BESS system shall be guaranteed for a period of ten years from the date of acceptance by the architect and/or electrical engineer.

1.02 RELATED DOCUMENTS

- A. The contractor shall comply with all requirements of Division 26 - Electrical in this specification book and with the conditions of the contract. The contractor shall comply with the general conditions of this specification for requirements for submittals, substitutions, testing, training, warranty, damage responsibility, permits, fees, clean-up, and all other general items, in addition to any specific requirements of this section.
- B. Work shall comply with all applicable codes, standards, local authorities, utilities and manufacturer's instructions/recommendations.
- C. The contractor shall comply with the BESS system construction document drawings, including all notes and specifications.
- D. BESS system layout is conceptual only. Contractor shall be responsible for complete set of BESS system construction documents based on conceptual plans and specifications to be submitted separately to building department for approval.
- E. These BESS system drawings are diagrammatic and represent the intent of equipment, devices, etc. to be connected and the circuits to which they are to be connected to. Contractor shall install all conduit, junction boxes, etc. as required for a complete and operational system.
- F. The contractor shall examine the architectural and electrical drawings to determine requirements.

- G. All work shall comply with the building department, health department, fire department, and all other local authorities having jurisdiction.
- H. All work, including equipment, materials, and installation shall conform to 2025 California Administrative Code, Title 24, Building Standards (CAC Title 24); to 2025 California Administrative Code, Title 8, Chapter 4, Division of Industrial Safety (DIS); 2025 California Electrical Code (CEC); and 2025 California Fire Code (CFC.)
- G. The minimum requirement of the more stringent code or standard shall govern where more than one code or standard is applicable to any component or condition.
- H. The contractor shall obtain and comply with manufacturer specifications, instructions and recommendations for all equipment and materials.
- I. The contractor shall immediately notify the architect and/or electrical engineer of any provision in the specifications that is contrary to the applicable codes.
- J. Any work performed by the contractor at variance with the applicable codes and without prior written approval of the architect and/or electrical engineer shall be corrected as required without additional cost to the owner.

1.03 REFERENCES

- A. California Electrical Code (CEC), based on the National Electrical Code with California amendments
 - 1. Article 706 – Energy storage systems.
 - 2. Article 705 – Interconnected electric power production sources.
 - 3. Article 250 – Grounding.
 - 4. Article 110 – Requirements for electrical installations.
- B. IEEE Standards
 - 1. IEEE 1679.1 – Lithium-based batteries in stationary applications.
 - 2. IEEE 929 – Inverter interconnection standard.
- C. Underwriter’s Laboratories (UL) standards
 - 1. UL9540 – Energy storage systems and equipment.
 - 2. UL1973 – Batteries for use in stationary power applications.
 - 3. UL1741, UL1741 Supplement A – Static inverters and charge controllers for use in distributed energy systems.
 - 4. UL9540A – Outline of investigation for large-scale fire test for BESS.
- D. National Fire Protection Association (NFPA) standards
- E. Occupational Safety and Health Administration (OSHA) standards
 - 1. 1926 Subpart M – Fall protection.

1.04 UTILITY APPROVAL

- A. Contractor shall submit interconnection application with local utility provider.
- B. Upon receipt of final building inspection approval, contractor shall immediately send a copy of the signed-off building permit to architect for scheduling of the final inspection with the local utility provider. Contractor shall be present for the final inspection.

1.06 CONTRACTOR QUALIFICATIONS

- A. The BESS system described herein shall be built by a licensed (C-46) solar contractor or a licensed (C-10) electrical contractor.
- B. BESS contractor shall be a NABCEP certified energy storage installation professional.

1.07 WARRANTY

- A. The contractor shall warrant that the work conforms to contract requirements and is free of any defects.
- B. The contractor shall provide a minimum of a full ten-year warranty against breakdown or degradation of electrical output. The warranty must cover all components of the BESS system against breakdown or degradation in energy storage capacity of more than 30% of their originally rated usable energy capacity. The warranty shall cover the full parts and labor cost of repair or replacement of defective components or systems.
- C. Any defective materials or inferior workmanship during installation and/or the warranty period shall be corrected immediately to the entire satisfaction of the architect and without additional cost to the owner.

1.08 SUBMITTALS

- A. Contractor shall provide shop drawings depicting BESS system layout. Shop drawings shall detail the proposed BESS unit layout scheme, voltage drop calculations and structural load calculations.
- B. Contractor shall provide shop drawings showing wall elevations for all inverter & BESS equipment locations. Elevations shall include location information for all inverters, disconnects, conduits, and gutters.
- C. Contractor shall provide information on all substituted BESS equipment, electrical service equipment, distribution equipment and panelboards, or other items specifically indicated.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide equipment as specified on the drawings, or equipment of equal quality and performance. Provide all accessories needed for complete, secure, operational grid-tied BESS systems.
- B. Bess contractor shall provide and install all equipment shown on these drawings except work labeled "E.C." or "by others". Electrical contractor shall provide and install all work labeled "E.C.".
- C. All materials, fixtures, and equipment required for the work shall be new and shall be furnished, delivered, erected, connected and finished in every detail, and shall be selected and arranged as to fit properly into the building spaces.
- D. All equipment shall be listed and labeled per recognized electrical testing laboratory and installed per the listing requirements and the manufacturer's instructions.
- E. All equipment shall be properly grounded per the requirements of CEC Article 250.
- F. All outdoor equipment shall be minimum NEMA 3R.
- F. All equipment shall be approved for use by the electric utility having jurisdiction and any applicable incentive programs.
- G. All connectors and couplers shall be of set screw type unless otherwise noted when run inside a building. All exterior connectors and couplers shall be rain tight.
- H. Any conduit runs shown are diagrammatic. Exact locations and conduit runs to be determined in the field prior to bid. Subcontractor shall provide documentation and legible drawings of all conduit placement deviating from plans.
- I. All exposed conduit shall be EMT or rigid metal conduit as per the requirements of Division 26 Specifications Section 260533, "Raceway and Boxes for Electrical Systems."
- J. All fused disconnect switches to be provided with rejection type fuse holders and viewing window for visible verification of blade separation.
- K. Current-limiting fuses within BESS systems are likely to be energized from both directions and shall comply with CEC 705.20 and CEC 240.40.
- L. All installed junction, pull and outlet boxes located behind equipment or panels shall be accessible directly or by displacement of equipment or panel(s) secured by removable fasteners.
- M. Each side of a power transformer shall be considered as primary and protected in accordance with CEC 450.3.

- N. If a PV system is integrated as part of the BESS system, equipment including but not limited to inverters, disconnects, panelboards etc. may be shared between the two systems where indicated by PV and BESS system drawings.

2.02 BATTERY ENERGY STORAGE SYSTEM

- A. BESS shall be listed to UL Standard 1973 and 9540, and inspected by local electrical utility provider before commissioning, testing, and operation of the system.
- B. BESS shall be tested for compliance with UL9540A testing requirements for large-scale fire test. Testing results must be from a NRTL lab location as indicated on the OSHA NRTL address list.
- C. BESS units shall be EndurEnergy ESP-BU30 or approved equal.

2.03 INVERTERS

- A. All inverters shall be IEEE 929 compliant, listed to UL Standard 1741, and inspected by local electric utility provider before commissioning, testing, and operation of the system.
- B. Inverter shall be equipped with integrated GFDI for ground fault protection.
- C. Inverter shall be of transformerless (TL) type.
- D. All inverters shall be Sol-Ark 60k-480V or approved equal.

PART 3 – EXECUTION

3.01 GENERAL

- A. All electrical work shall be in accordance with the 2025 California Electrical Code, local building department regulations, and local fire district regulations.
- B. BESS plans shall be approved by the fire department as required by local AHJ requirements prior to final approval.
- C. All BESS circuit conductors shall have overcurrent devices located so as to provide overcurrent protection from all sources per CEC Article 706.31.
- D. Labels per NEC Art. 705.10, 705.20(8), 706.15(c), and 706.21 shall be provided.
- E. Bess system shall be interconnected with the utility grid and shall backfeed the distribution system on site per the requirements of CEC Art. 705.12. All plug-in type backfed breakers shall be

identified as such. The backfed power source must be listed and identified as interactive, else the breaker shall be secured in place by an additional fastener per the requirements of CEC 408.36 (D.)

- F. If equipment cannot be properly concealed, notify architect and/or electrical engineer. Any patching and cutting done as a result of error or neglect on the part of the contractor shall be done at the expense of the contractor.
- G. Attachments: support all work adequately and per code. All equipment shall be securely attached to the foundation and/or building structure in an approved manner. Attachments shall be of a strong and durable nature.
- H. Shoring: the contractor shall provide all permanent and temporary shoring, anchoring and bracing required by the nature of this work in order to make all parts absolutely stable and rigid, even when such shoring, anchoring and bracing are not explicitly called for.
- I. Contractor shall keep work areas in a clean and safe condition. Remove all equipment, tools, vehicles, rubbish, waste and debris from the site upon completion of the job. The contractor shall pay all fees for recycling and disposal.
- J. Fall arrest protection per OSHA 1926 Subpart M shall be provided for all roof work.
- K. Penetrations of all fire rated walls or ceilings shall be fire rated in accordance with all local, state, and national codes.

3.02 ENERGY STORAGE FUNCTIONALITY REQUIREMENTS

- A. The BESS shall have the capability of being remotely programmed to change the charge and discharge periods.
- B. During discharge, the battery storage system shall be programmed to first meet the electrical load of the dwelling unit(s). If during the discharge period the electrical load of the service is less than the maximum discharge rate, the battery storage system shall have the capability to discharge electricity into the grid upon receipt of a demand flexibility signal from the local utility or a third-party aggregator.
- C. The BESS shall operate in one of the following control strategies:
 - 1. Basic control

When combined with an on-site solar photovoltaic system, to qualify for the basic control, the battery storage system shall be installed in the default operation mode to allow charging only from an on-site photovoltaic system when the photovoltaic system production is greater than the on-site electrical load. The battery storage system shall discharge only when the photovoltaic system production is less than the on-site electrical load.
 - 2. Time-of-use (TOU) control

When combined with an on-site solar photovoltaic system, to qualify for the TOU control, the battery storage system shall be installed in the default operation mode to allow charging only from an on-site photovoltaic system. The battery storage system shall begin discharging during the highest priced TOU hours of the day. The operation schedule shall be preprogrammed from the factory, updated remotely, or programmed during the installation/commissioning of the system. At a minimum, the system shall be capable of programming three separate seasonal TOU schedules, such as spring, summer, and winter.

3. Advanced demand flexibility control

When combined with an on-site solar photovoltaic system, to qualify for the advanced demand flexibility control, the battery storage system shall be programmed by default as basic control as described in JA12.2.3.1 or TOU control as described in JA12.2.3.2. The battery storage control shall meet the demand flexibility control requirements specified in California Title 24, Part 6, Section 110.12(A). Additionally, the battery storage system shall have the capability to change the charging and discharging periods in response to signals from the local utility or a third-party aggregator.

4. Controls for separate battery storage system

When installed separate from (not in combination with) an on-site solar photovoltaic system, including when the building is served by a community solar PV system, to qualify for the compliance credit, the battery storage system shall be programmed by default to:

- i. Start charging from the grid at the onset of lowest priced TOU hours of the day and start discharging at the onset of highest priced TOU hours of the day,

Or,

- ii. Meet the demand flexibility control requirements specified in section 110.12(A), and shall have the capability to change the charging and discharging periods in response to signals from the local utility or a third-party aggregator.

- D. The battery management system should reserve 10% of total capacity (90% depth of discharge) to maintain battery health, unless high reserve is recommended by the manufacturer.
- E. The battery storage system shall perform a system check on the following dates, to ensure the battery is operating in one of the approved control strategies described in Section 3.02(C) of this document.

3.03 CONDUCTORS

- A. All conductors shall be copper unless otherwise noted.
- B. All proposed conductors rated for 90°C, however ratings shall be assumed to be 75°C for all building feeders and therefore terminations prior to connection. Intermediate junction box may be required to change from 90°C to 75°C.
- C. Wiring material shall be copper and 90°C rated, suitable for sun exposure and suitable for wet locations. Field applied coatings are not acceptable.
- D. All wire run across roof to combiner boxes shall be of insulation type THWN-2 or USE-2. PV wires that are UL listed for use in PV applications are also permitted to be used in the source circuits.
- E. All homerun wire runs of length greater than 20' shall be made through a NEMA 3R minimum rated junction box with THWN-2 conductors in conduit.

3.04 CONDUITS & RACEWAYS

- A. Rigid galvanized steel conduit shall be used in all areas exposed to weather or physical damage.
- B. Flexible metallic conduit shall only be used in areas as permitted by local code authority. Use Seal-Tite in areas exposed to weather.
- C. Where electrical metallic tubing (EMT) is utilized, compression type fittings are to be used.
- D. All conduit below grade shall be electrical PVC. PVC conduit shall be used with code sized ground. Conduit risers and stubs above grade shall be IMC with half-lapped tape covering or PVC coating.
- E. All conduits exposed in electrical pads or rooms shall be of type specified in the single line diagram and/or conductor schedule.
- F. Conduits penetrating fire rated areas shall be sealed, inside and outside of conduit, with approved fire stop material to maintain the same fire ratings as original.
- G. Conduit shall be secured at 10 ft minimum intervals.
- H. Conduit for roof mounted equipment may be routed below the roof surface within the building.

3.05 GROUNDING

- A. All equipment shall be properly grounded per the requirements of CEC Article 250.
- B. All services supplying the building shall have the same grounding electrode system.
- C. Ground bond conductor shall not be spliced.
- D. Grounding system used is a combined AC/DC system.
- E. BESS inverter shall be a transformerless-type inverter. Dedicated grounding electrode conductor is not required for BESS source. Equipment grounding conductor shall be use as grounding electrode conductor per the exception in CEC 250.121 .
- F. Use equal or approved "lay in lug" (ILSCO, UL467 rated, high strength copper alloy with SS screw as necessary) for grounding and bonding.
- G. When integrated Webb grounding is not available, DC equipment ground shall be minimum 6 AWG bare solid copper wire.
- H. Contractor shall confirm building and panel grounding (existing or new where applicable) prior to installation.

3.06 TESTING & INSPECTIONS

- A. The contractor shall notify the architect and/or electrical engineer a minimum of 5 days before closing in of to-be-concealed work so that an owner's representative may inspect the work.
- B. Before starting or operating the system, contractor shall check continuity of all conductors and grounding conductors to verify that there are no faults and that all equipment has been properly installed. Check factory instructions to see that installations have been made accordingly. Check equipment for any damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment or replace with new equipment of like kind.
- C. Before starting or operating the system, contractor shall obtain a final inspection approval from the building department and a final inspection approval from local utility provider. Contractor shall be present on site for both of these inspections.
- D. Once the building department and local utility provider approvals have been received, contractor shall test all equipment to ensure specified capacity and performance of the system. The contractor shall notify the architect and/or electrical engineer a minimum of 5 days prior to the test so that an owner's representative may witness the test. Contractor shall replace or revise any equipment, systems, or work found deficient during the test.
- E. Contractor shall make final adjustments to all inverters so that they will be placed in an acceptable operating condition.

3.07 COMMISSIONING

- A. Contractor shall, in addition to instructions from the manufacturer requirements from local ahj and utility, provide the following:
1. Provide a complete commissioning of the BESS systems.
 2. Verify that all equipment is installed and connected according to the requirements of the BESS drawings, specifications, and manufacturer's written instructions.
 3. Review project documents prior to installation to verify project requirements.
 4. Test fire and safety systems per installation manual.
 5. Test thermal management, ventilation, and exhaust system per installation manual.
 6. Identify and provide owner's operation manual to the owner prior to or at the time of commissioning.
 7. Coordinate with and provide on-site staff documentation and training required for maintenance and safe operation of system. Provide instructions to in-site staff for system emergency shutdown.
 8. Provide contact information to owner and on-site representatives of persons personally authorized to perform maintenance of the systems.
 9. Verify and monitor system to ensure that system maintenance requirement performance meets original design intent.
 10. Provide plan for removal of BESS per manufacturer instructions. System shall be decommissioned and removed from the installation location per manufacturer instructions.
 11. Replace all damaged and/or malfunctioning equipment.

3.08 DEMONSTRATION

- A. Provide a complete set of operation documentation, a walk-through of system operation, and training for service for the BESS system.
- B. Train owners' maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
- C. Schedule training with contracting officer with at least seven days' advance notice.
- D. Any and all documentation necessary for the safe operation & maintenance of the system shall be provided by BESS contractor and stored on-site.

END OF SECTION