DSA SUBMITTAL

El Monte High School Track and Field

3048 Tyler Avenue, El Monte, CA 91731

DSA Application Number: 03-122306

DSA File Number: 19-H10

Project Number: 3361004

El Monte Union Unified School District

3537 Johnson Avenue, El Monte, CA

June 6, 2022

HMC Architects

PRINT DATE: 07.11.23

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IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-122306 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 10/27/2023

SECTION 00 01 01

CERTIFICATIONS

El Monte High School Track and Field
El Monte Union High School District
El Monte, CA

June 6, 2022
HMC #3361004

LICENSED ARCHITECT
VIRGINIA ELAINE MARQUARDT
No. C-33423
06/30/2025
RENEWAL DATE
STATE OF CALIFORNIA

HMC ARCHITECTS
Architect

REGISTERED PROFESSIONAL ENGINEER
JOSH RANDALL
No. 4506
Exp. 06-30-25
STRUCTURAL
STATE OF CALIFORNIA

Structural Engineer

REGISTERED PROFESSIONAL ENGINEER
KEVIN G. SHORT
E17249
EXP. 06-30-2024
ELECTRICAL
STATE OF CALIFORNIA

PBS Engineers
Electrical Engineer

LICENSED LANDSCAPE ARCHITECT
CRAIG THOMAS DUNCAN
2903
JULY 2024
STATE OF CALIFORNIA

Landscape Architect

Alan Wing-Chi Lee C # 34971
Alan Wing-Chi Lee

REGISTERED PROFESSIONAL ENGINEER
ALAN WING CHI LEE
C34971
Exp: 9-30-23
CIVIL
STATE OF CALIFORNIA

Civil Engineer

SECTION 01 10 00.13 - PROJECT INFORMATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Work covered by Contract Documents.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
   1. Demolition at existing Track and Field Stadium:
      a. Demo existing Track Surface.
      b. Demo existing natural Turf, Football/ Soccer Field and related Irrigation.
      c. Demo existing Scoreboard and Flagpole.
      d. Demo existing Hardscape/ Site Walls, Landscape and Irrigation in areas Identified in the Construction Documents.
   2. New Track and Field Stadium:
      a. New Synthetic Turf Field and rubberized Running Track.
      b. New Scoreboard.
      c. Standard Field Electrical and Low Voltage.
      d. New Flagpole and Footing.
      e. New Ground mounted up-lighting to light existing Mural.
      f. New Goal Post and Footing.
      g. New Fences and Gates as noted on Construction Documents.
      h. Extension to existing Retaining Wall.
      i. New Guardrails at existing Drinking Fountains.
      j. Site Improvements include but are not limited to Walkways, Utilities and Landscaping.
      k. New Slurry Coat & restripe Accessible Parking Areas.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 35 42

CALGREEN REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes general requirements and procedures for compliance with 2019 CALGreen nonresidential mandatory requirements.

B. Related Sections:
   1. Divisions 01 through 33 Sections, as applicable, for CALGreen requirements specific to the work of each of those Sections.

1.02 SUBMITTALS

A. CALGreen submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated CALGreen requirements.

B. Contractor shall develop a spreadsheet to track submittals required by CALGreen.

C. CALGreen Submittals:
   1. Furnish documentation showing verification of CALGreen compliance as required by Division of the State Architect - Structural Safety (DSA-SS).
   2. Section 5.106.1 - Storm Water Loss Prevention Plan: Newly constructed projects and additions which disturb less than one acre of land shall prevent the pollution of stormwater runoff from the construction activities through one or more of the following measures:
      a. Local ordinance, 5.106.1.2.
      b. Best management practices (BMP) complying with Section 5.106.1.2.
   3. Section 5.106.10 - Grading and Paving: Furnish drawing showing grading and paving designed to keep surface water from entering buildings.
   4. Section 5.408.1.4 - Construction Waste Management Plan: Furnish a construction waste management plan complying with specified requirements.
   5. Section 5.504.4.3.2 Verification - Contractor to verify if this section is requested by DSA. Documentation may include, but is not limited to, the following:
      a. Manufacturer's product specification, and
      b. Field verification of on-site product containers.
   6. Section 5.504.4.5.3 - Composite Wood Products: Furnish documentation showing compliance with Section 5.504.4.5.
   7. Section 5.504.5.6.1 - Resilient Flooring: Furnish documentation showing resilient flooring materials meet the pollutant emission limits.

1.03 SUMMARY OF CALGREEN REQUIREMENTS

A. Division 5.1 - Planning and Design:

1. Section 5.106.4 - Bicycle Parking: Comply with Section 5.106.4.2, as applicable, for short-term and long-term bicycle parking.
2. Section 5.106.8 - Light Pollution Reduction: Comply with Section 5.106.8.1 for outdoor lighting systems.

B. Division 5.3 - Water Efficiency and Conservation:
   1. Section 5.304.6 - Outdoor potable water use in landscape areas: Comply with Section 5.304.6.1 and 5.304.6.2, California Department of Water Resources Model Water Efficient Landscape Ordinance (MWELO).

C. Division 5.4 - Material Conservation and Resource Efficiency:
   1. Section 5.407 - Water Resistance and Moisture Management: Comply with requirements specified in Section 5.407 for Weather Protection and Moisture Control.
   2. Section 5.408 - Construction Waste Reduction, Disposal and Recycling: Comply with requirements specified in Section 5.408.1.
      a. Recycled and/or salvage for reuse a minimum of 65-percent of the nonhazardous construction and demolition waste or meet a local construction and demolition waste management ordinance, whichever is more stringent.
      b. Where the local jurisdiction does not have a construction and demolition waste management ordinance, submit a construction waste management plan with the following:
         1) Identify the materials to be diverted from disposal by efficient usage, recycling, reuse on the Project or salvage for future use or sale.
         2) Determine if materials will be sorted on-site or mixed.
         3) Identify diversion facilities where material collected will be taken.
         4) Indicate the amount of materials diverted, calculated by weight or volume, but not by both.
      c. Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with Section 5.408.1.2.
      d. The combined weight of new construction disposal that does not exceed 2-pounds per sq. ft. of building area may be deemed to meet the 65-percent minimum requirement.
      e. Documentation shall be provided to the enforcing agency which demonstrated compliance with Section 5.408.1 thru 5.408.1.3. The waste management plan shall be updated as required and shall be accessible during construction for examination by the enforcing agency.
      f. 100-percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled.
      g. 5.408.1.4 - Documentation: Documentation shall be provided to DSA which demonstrates compliance with Sections 5.408.1.1 through 5.408.1.3.
   3. Section 5.410 - Building Maintenance and Operation: Comply with the requirements specified in Section 5.410.
      a. Provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of non-hazardous materials for recycling, including paper, corrugated cardboard, glass, plastics and metals.

b. For new buildings of 10,000-sq. ft. or more, comply with the commissioning requirements specified in Section 5.410.2. Commissioning shall be performed by trained personnel with experience on projects of comparable size and complexity. General commissioning requirements include the following. The specific requirements of each item are specified in Section 5.410.2.1 thru 5.410.2.6.
   1) Owner's or Owner Representative's project requirements.
   2) Basis of design.
   3) Commissioning measures shown in the Construction Documents.
   4) Commissioning plan.
   5) Functional performance testing.
   6) Documentation and training.
   7) Commissioning report.

c. For new buildings less than 10,000-sq. ft., test and adjust systems as specified in Sections 5.410.4.2 thru 5.410.4.5.

D. Division 5.5 - Environmental Quality:
   1. Section 5.504 - Pollutant Control: Comply with the requirements specified in Section 5.504.
      a. Cover duct openings and protect mechanical equipment during construction as specified in Section 5.504.3.
      b. Finish materials shall comply with the requirement specified in Sections 5.504.4.1 thru 5.504.4.4, as follows:
         1) Adhesives, adhesive bonding primers, adhesive primers and caulks shall meet the following requirements:
            a) Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.2.
            b) Aerosol adhesives and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.
         2) Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table 5.504.4.3 unless more stringent local limits apply.
            a) Aerosol paints and coatings shall meet the PWMIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, ion Sections 94522(c)(2) and (d)(2) of CCR, Title 17, commencing with Section 94520 and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49.
         3) Carpet shall meet the testing and product requirements of one of the following, as required by Section 5.504.4.4:
            a) Carpet and Rug Institute's Green Label Plus Program.

b) California Department of Public Health Standard Practice for the testing of VOCs (Specification 01350).
c) NSF/ANSI 140 at the Gold level.
d) Scientific Certifications Systems Sustainable Choice.
e) California Collaborative for High Performance Schools (CA-CHPS) and listed in the CHPS High Performance Product Database.

4) Carpet cushion shall meet the requirements of the Carpet and Rug Institute Green Label program.
5) Carpet adhesive shall meet the requirements of Table 5.504.4.1.
6) Composite wood products, including hardwood plywood, particleboard and medium density fiberboard, used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB's Air Toxics Control Measure for Composite Wood (17 CCR 93120 et seq.) by or before the dates specified in those sections, as shown in Table 5.504.4.5.
7) For 80% of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the following:
a) Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program.
b) Compliant with the VOC emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for the Testing and Evaluation Chambers, Version 1.1, February 2010.
c) Compliant with California Collaborative for High Performance Schools (CA-CHPS) Criteria Interpretation for EQ2.2 dated July 2012 and listed in CHPS High Performance Product Database.
d) Compliant with CDPH criteria as certified under the Greenguard Children's & Schools Programs.

c. Provide regularly occupied areas of the building with air filtration media for outside and return air prior to occupancy that provides at least a MERV of 13 as specified in Section 5.504.5.3.
d. Where outdoor areas are provided for smoking, prohibit smoking within 25-feet of building entries, outdoor air intakes and operable windows and in buildings; or as enforced by ordinances, regulations or policies of any city or county, whichever are more stringent. Post signage to inform building occupants of the prohibitions.

2. Indoor Moisture Control: Comply with the requirements specified in Section 5.505.
3. Indoor Air Quality: Comply with the requirements specified in Section 5.506.
4. Environmental Comfort: Comply with the requirements specified in Section 5.507.
5. Outdoor Air Quality: Comply with the requirements specified in Section 5.508.

E. Summary:
1. Certain CALGreen Measures needed to comply with code are dependent on material selections, documentation and means and methods of the work. Each item related to CALGreen may not be specifically identified as CALGreen requirements in this Section. Refer to CALGreen Code, CCR Title 24, Part 11 for complete descriptions of measures and submittal requirements.

2. Designate an onsite field staff person contact for all CALGreen prerequisites and credit documentation, subcontractor supervision and submittal coordination and to manage the Contractor's portions of the CALGreen submittal process.
3. Documentation for CALGreen Measures shall be submitted in the format required by the CALGreen code.
4. A copy of the CALGreen code, CCR Title 24, Part 11 shall be available on-site at all times.
5. Additional information on CALGreen can be found at http://www.bsc.ca.gov.

F. Meetings:
1. Contractor shall conduct CALGreen compliance meetings as required. Contractor personnel who shall attend CALGreen compliance meetings include, but are not limited to:
   a. Contractor's project manager.
   b. Owner's Representative.
   c. Other attendees designated by Owner's Representative.
   d. Subcontractor representatives as appropriate to stage of work.
2. At a minimum, CALGreen compliance issues shall be discussed at the following meetings:
   a. Preconstruction meetings.
   b. Progress meetings.
   c. Subcontractor meetings.
   d. Meetings shall be scheduled as part of regularly scheduled job meetings on-site.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Reference Standards.

B. Quality Assurance and Control of Installation.

C. Field Samples.

D. Mock-up

E. Project Inspector and Inspections.

F. Permits and Fees.

G. Verified Reports.

H. Manufacturers' Field Services and Reports.

I. Laboratory Testing Services.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. For products or workmanship specified by Association, Trade or Federal Standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy of standards at jobsite during submittals, planning and progress of the specified Work until Certified Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

F. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION

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

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

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

D. Perform Work by persons qualified to produce workmanship of specified quality.

E. Where experience minimums for workmen, applicators, companies or manufacturers are required in individual Sections, written certification and documentation substantiating such minimums shall be submitted and approved by the Architect, when requested.

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

G. Field Samples:
   1. Obtain field samples for review by Architect.

H. Mock-Ups:
   1. Test will be performed under provisions identified in this Section.
   2. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals and finishes.
   3. Where mock-ups are specified in individual Sections, shall be removed after approval per this Section unless are indicated to remain as part of the Work.

1.04 PROJECT INSPECTOR

A. An Inspector, herein referred to as the "Project Inspector", "Job Inspector", or "Inspector of Record" (IOR) will be employed by the Owner approved by the Architect, Structural Engineer, and the Division of State Architect (DSA) in accordance with 2019 California Code of Regulations, Title 24, Part 1, California Administrative Code, Section 4-333(b). The Inspector of Record's duties are described in CAC Sections 4-341(d), 4-342, and DSA Procedure 13-01.

B. Class of Inspector required for this project in accordance with Title 24, Part I, Section 4-333.1.

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

1.05 PERMITS AND FEES

A. Where required by the provisions of individual sections of the Specifications, and where required to carry out construction operations, Contractor shall obtain and pay for permits and fees, including, but not limited to, Demolition, Grading, Disposals, requirements of Water, Gas, Sewer, Flood and Sanitary Districts, Municipal and County Building Departments having jurisdiction.
   1. Fees for final utility connections shall be paid by the Contractor and reimbursed to the Contractor by the Owner at direct cost.
   2. Building Permits or approvals issued by DSA requiring fees will be obtained and paid by the Owner.

1.06 DSA BOX

A. All DSA required documents shall be submitted via DSA Box per DSA PR 13-01.

B. DSA Box is a secure cloud based collaborative solution initiated by the Division of the State Architect (DSA) to allow greater transparency and communication between DSA Field Engineers and designated stakeholders.
   1. Invitation shall be sent by email from Box.com.
   2. Additional information can be found at:
   3. www.dsg.ca.gov/dsa/Programs/progProject/dsabox.aspx

1.07 VERIFIED REPORTS

A. Contractor shall comply with CAC Section 4-336 and 4-343 and issue verified reports through the Architect as required.

1.08 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and as applicable and to initiate instructions when necessary.

B. Manufacturers' representatives shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report of observation to Architect for review.

1.09 CODES AND REGULATIONS

A. All work pertaining to and all materials supplied for executing and completing this Contract shall comply with provisions specified in the Contract Documents and with all applicable laws, regulations and ordinances governing Work including, but not necessarily limited to, those of:
   1. California Code of Regulations (CCR), Title 24, California Building Standards Code

a. CAC - 2019 California Administrative Code, 24 CCR Part 1.
b. CBC - 2019 California Building Code, 24 CCR Part 2, Volumes 1 and 2.
c. CEC - 2019 California Electrical Code, 24 CCR Part 3.
d. CMC - 2019 California Mechanical Code, 24 CCR Part 4.
e. CPC - 2019 California Plumbing Code, 24 CCR Part 5.
f. 2019 California Energy Code, 24 CCR Part 6.
g. CFC - 2019 California Fire Code, 24 CCR Part 9.
h. CALGreen - 2019 California Green Building Standards Code, 24 CCR Part 11.
i. CRSC - 2019 California Reference Standards Code, 24 CCR Part 12

2. California Code of Regulations (CCR), Title 19, Public Safety, Division 1, State Fire Marshal.
3. Addenda Compliance per CAC Section 4-338(b), Part 1.

B. Administrative Regulations, CCR Title 24, Part 1, California Administrative Code, Chapters 1, 4, 5:
1. DSA not subject to Arbitration.
2. Copy of Part 1 and Part 2, Volume 1 and 2 (CBC), and Parts 3 through 5 of Title 24 CCR, shall be kept and made available at the construction site office during construction.

C. ADA - Americans with Disabilities Act of 1990, as amended:
1. Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

D. Enforcement includes all other codes, regulations, or standards referenced in the above listed codes.

E. The preceding listed codes, regulations and ordinances of the regulatory agencies are hereby made a part of this Contract. Nothing in the Contract shall be construed as allowing any violation of any provision of any of above listed documents. Maintain copies of Codes listed above at the construction site.

F. Should any existing conditions such as deterioration or noncomplying construction be discovered which is not covered by the DSA approved documents wherein the finished work will not comply with Title 24, California Code of Regulations, a construction change document, or a separate set of Drawings and Specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work.

1.10 VARIATIONS WITH LAWS

A. If Contractor, his subcontractors or suppliers, or any of their employees ascertain at any time that requirements of this Contract conflict with or are in violation of applicable laws, codes, regulations and ordinances he shall not proceed with Work in question, except at his own risk. Contractor shall be required to remove that Work from site and replace such Work with all complying Work at no additional cost to Owner.

1.11 SELECTION AND PAYMENT - TESTING LABORATORY AND SPECIAL INSPECTORS

A. Owner will employ and pay for services of independent Testing Laboratory and Special Inspectors approved by Architect and DSA to perform inspection and testing in accordance with Part 1, Title 24, Section 4-335, California Code of Regulations and this Section.

B. Offsite fabrication requiring Inspection and Testing: submit the qualifications of Inspectors and laboratory, including proposals for services, to the Owner and Architect for approval of qualifications and costs. Inspectors and laboratories shall conform to the requirements of Part 1 Title 24 Section 4-335.

C. Inspector of Record (IOR) / Testing Laboratory Travel Expenses:
   1. Initial Testing. For initial testing required by this Manual, Owner shall pay IOR, Testing Laboratory or both, for travel expenses, including mileage, room and board, when travel for inspection and testing of products purchased by the Contractor exceeds 50 miles or 2 hours from the project site.
   2. Additional Testing. When initial testing fails, IOR and Testing Laboratory travel expenses, as described above, attributable to required retesting shall be borne by the Contractor and will be deducted by Change Order from funds due and payable, or that become due and payable to Contractor.
   3. IOR, Testing Laboratory or both, as applicable, shall forward billings and records of such expenses to the Owner.

D. When tests and inspections are required on an overtime basis, initial payment will be made by Owner. At termination of Work or completion of Project, all costs for overtime testing and inspections will be deducted from Contractor's final payment (or any funds due and payable) by Change Order.

E. Before the Testing Laboratory files testing and inspection billings with Owner, they shall be billed indicating segregated straight time from overtime costs. All overtime costs shall be substantiated with detailed explanation for necessity of such work costs.

F. When materials tested fail to meet requirements herein specified, they shall be promptly corrected or removed and replaced, re-inspected and retested in a manner required by the Architect. Costs involved in re-inspection and retesting will be paid by the Owner and deducted from Contractor's final payment (or any funds due and payable) by Change Order.

G. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.12 LABORATORY RESPONSIBILITIES

A. Laboratory shall be licensed to conduct testing and inspection operations in California and shall be approved by DSA. It shall be supervised by a State Licensed Civil Engineer who shall certify and sign all reports.

B. Provide qualified personnel at site. Cooperate with Architect, Project Inspector and Contractor in performance of services.

C. Perform specified inspection, sampling and testing of products in accordance with standards specified herein.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify Architect, Project Inspector and Contractor by letter of observed irregularities or non-conformance of Work or products.

F. Perform additional inspections and test required by Architect or governing agencies.

G. Immediately upon Testing Laboratory determination of a test failure, the laboratory shall telephone the results of test to Architect. On the same day, laboratory shall send written test results to those named on the distribution list below.

1.13 LABORATORY REPORTS

A. After each inspection and test, promptly submit one copy of laboratory report to the following:
   1. Owner.
   2. Contractor.
   3. Inspector of Record (IOR).
   4. Special Inspectors: Special Inspector's Verified Reports as required by Section 4-336 and shall be submitted in a timely manner.
   5. Architect.
   6. Structural Engineer.
   7. Mechanical and Electrical Engineers (Related Tests and Inspections).
   8. Division of the State Architect (DSA)

B. Include:
   1. Date issued.
   2. Project title, Architect's number, DSA Application and File number.
   3. Name of inspector.
   4. Date and time of sampling and Specifications Section.
   5. Identification of product and Specifications Section.
   6. Location in the Project.
   7. Type of inspection or tests.
   8. Date of test and ambient conditions at time of test.
   9. Results of tests.
   10. Conformance with Contract Documents.
   11. Signature by Registered Professional Engineer licensed in California.
   12. Statement that tests were conducted in accordance with Parts 1 and 2, Title 24, California Code of Regulations.

C. Test reports shall include tests made, whether such tests indicate that the material performed satisfactorily or not. Samples taken but not tested shall be reported. Reports shall show that the materials were sampled and tested in accordance with the requirements of the approved Specifications. Reports shall show the specified design strength and shall state whether or not the materials tested comply with requirements. Report special sampling operations where required.

D. Submit a report verifying that tests and inspections herein specified and otherwise required have been completed and material and workmanship complies with the Contract Documents. Such verification reports shall be submitted at the completion of the Project and at any time the Project is suspended. Parties to receive such reports are the same as listed above.

E. When requested by Architect, provide interpretation of test results.

1.14 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop the Work.

E. Laboratory shall not interpret code in relation to the design of the building.

1.15 CONTRACTOR RESPONSIBILITIES

A. Administration of construction by Contractor per CAC Section 4-330 and 4-343.

B. Deliver to laboratory at designated location, adequate samples of materials proposed to be used which require testing. Selection of materials required to be tested shall be by the Lab or Owner's Representative and not by the Contractor.

C. Cooperate with laboratory personnel, Owner's Representative, Project Inspector and the Architect, and provide access to the Work including weekends and after work hours and to manufacturer's facilities.

D. Provide incidental labor materials and facilities to provide at all times, safe access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

E. Notify Architect, Project Inspector and laboratory 48 hours prior to expected time for operations requiring inspection and testing services. Contractor shall pay for costs incurred if testing or inspections are cancelled and are required to be rescheduled due to the Contractor's failure to notify the Project Inspector in advance as required. Also, notify Owner in advance of manufacturer of materials to allow testing at source of supply.

F. In accordance with CBC Chapter 17A, Section 1704A.3, Contractor shall execute and submit a Statement of Responsibility regarding special inspections and testing required for principal wind- and seismic-load bearing systems to the Inspector of Record and the Owner.

G. The Owner, Project Inspector, or the Architect shall have the right to reject materials and workmanship that are defective or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without cost to the Owner. If the Contractor fails to correct such rejected Work within a reasonable time, fixed by written notice, the Owner will correct same and charge the expense to the Contractor by Change Order.

H. Should it be considered necessary or advisable by the Owner at any time before date of completion of the entire Work to make an examination of Work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such Work is found to be defective in any respect due to fault of the Contractor or his subcontractor, all extra expenses shall be charged to the Contractor by Change Order. If however such Work is found to meet the requirements of the Contract Documents, the additional cost of labor and materials involved in the examination and for replacement costs shall be allowed to the Contractor by Change Order.

I. When changes of construction schedule are necessary during construction, coordinate such changes with the Testing Laboratory as required.

J. When the Testing Laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, extra charges for testing attributable to the delay shall be charged to the Contractor by Change Order.

K. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

L. Selection of materials to be tested shall be made by the Testing Laboratory or the Project Inspector and not by the Contractor.

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

1.16 SCHEDULE OF STRUCTURAL TESTS AND INSPECTIONS

A. Test and inspections for the following will be performed in conformance with the California Building Code, Title 24, Part 2, of the California Code of Regulations, and the DSA Interpretations of Regulations (IR) Manual.

B. Structural tests and inspections will be performed in accordance with CBC Chapter 17A.

C. Foundations and Retaining Walls (CBC Chapter 18A).
   1. Inspection:
      a. Piles: 1705A.7
      b. Pier Foundations: 1705A.8

D. Concrete (CBC Chapter 19A).
   1. Materials:
      a. Portland Cement: 1705A.3.2; 1910A.1
      b. Concrete Aggregates: 1705A.3.2; 1903A.5
      c. Shotcrete Aggregates: 1908A.3
      d. Reinforcing Bars: 1705A.3.2; 1910A.2
      e. Prestressing Steel and Anchorage: 1705A.3.2; 1910A.3
   2. Quality:
      a. Proportions of Concrete: 1910A.1; Table 1705A.3, Item 5
      b. Strength Tests of Concrete:1905A.1.16; Table 1705A.3, Item 6; ACI 318-14 Sec. 26.12
      c. Shotcrete Proportions: 1908A.2
      d. Shotcrete Cores: 1908A.5
      e. Composite Construction Cores: 1910A.4
   3. Inspection:
      a. Batch Plant: 1705A.3.3
      b. Waiver of Batch Plant: 1705A.3.3.A
      c. Preplacement and Placing: 1705A.3.5; 1705A.3.6
      d. Prestressed Concrete: 1705A.3.4
      e. Shotcrete: 1705A.19; 1908A
      f. Post-Installed Anchors in Concrete: 1910A.5; Table 1705A.3, Items 4a and 4b
      g. Reinforcing Bar Welding: 1903A.8; 1705A.3.1; Table 1705A.3, Item 2; Table 1705A.2.1, Item 5b.

E. Masonry (CBC Chapter 21A)
   1. Materials
      a. Masonry Units: 2103A.1
      b. Portland Cement, Lime: 2103A
      c. Mortar and Grout Aggregates: 2103A.2; 2103A.3
      d. Reinforcing Bars: 2103A.4
   2. Quality
      a. Portland Cement Tests: 1910A.1
      b. Mortar and Grout Tests: 2105A.3
      c. Masonry Prism Tests: 2105A.2
      d. Masonry Core Tests: 2105A.4
      e. Masonry Unit Tests: 2105A.2; 2105A.3; 1705A.4
      f. Reinforcing Bar Tests: 1910A.2
   3. Inspection:
      a. Reinforced Masonry: 1705A.4
      b. Reinforced Bar Welding: 1903A.8; 1705A.3.1; Table 1705A.3, Item 2; Table 1705A.2.1., Item 5b
      c. Post-Installed Anchors in Masonry: 1705A.4; 1910A.5; 1616A.1.19; Table 1705A.3, Items 4a and 4b

F. Steel (CBC Chapter 22A)
   1. Materials:
      a. Structural Steel: 2205A.1
      b. Cold Formed Steel: 2210A.1
      c. Identification: 2203A.1
   2. Quality:
      a. Tests of Structural and Cold-Formed Steel: 2211A.1
      b. Tests of High Strength Bolts, Nuts Washers: 2213A.1
      c. Tests of End Welded Studs: 2213A.2
      d. Steel Joists: 2207A; 1705A.2.3.1
      e. Non-Destructive Weld Tests: 1705A.2.1
   3. Inspection:
      a. Shop Fabrication: 1704A.2.5; 1705A.2
      b. Welding: 1704A.2.5; 1705A.2
      c. Nelson Stud Welding: 1705A.2.1
      d. High Strength Bolt Installation: 1705A.2.1; Table 1705A.2.1

1.17 EXPANSION BOLTS OR EPOXY-TYPE ANCHORS - APPROVED ANCHORS

A. Basis of Design Capacities: Design capacities for expansion type and epoxy (adhesive) type anchors should reflect the tested capacity of the anchors including the degree of scatter in the recorded peak loads and the load-displacement response, the type and mechanical properties of the concrete or masonry in which the anchor is installed, anchor edge distance and spacing, and whether the anchors are installed through metal decking into concrete fill. In addition, the potential for concrete cracking in the vicinity of the anchor during its service life and the effect of such cracking on the capacity of the anchor to resist loads shall be considered. The effects of temperature variations on epoxy (adhesive) type anchors shall also be taken into account where applicable. The age, composition and mechanical properties of the materials in which the anchor will be installed shall be evaluated.

B. The relevant mechanical properties include unit weight, compressive strength, and aggregate size and type. Evaluation of compressive strength on the basis of cores taken at or near the anchor locations shall be permitted. The compressive strength of the material in which the anchor will be installed shall meet or exceed the compressive strength of the material in which the anchor was tested.

C. Expansion-type anchors: Concrete
   1. Kwik Bolt TZ 2 (KB-TZ2) Concrete Anchor, 3/8- to 3/4-inch diameter, ICC ESR-4266, by Hilti Inc., Tulsa, OK.
   2. Simpson Strong-Bolt 2 concrete anchor, 1/2-, 5/8-, 3/4- and 1-inch diameter, ICC ESR-3037, by Simpson Strong-Tie, Pleasanton, CA,
   3. Power-Stud+SD2 concrete anchor, 3/8- to 3/4-inch diameter, ICC ESR-2502, by DeWalt, Towson, MD.
   4. Or equal with ICC Report Number.

D. Expansion-type anchors: Grout filled CMU Masonry
   1. Kwik Bolt TZ 2 (KB-TZ2) Masonry Anchors, 1/4- to 3/4-inch diameter, ICC ESR-4561, by Hilti.

2. Wedge-All grout-filled CMU anchor, 3/8-, 1/2-, 5/8-, and 3/4-inch diameter, ICC ESR-1396, by Simpson Strong-Tie.
3. Power-Stud+SD1 masonry anchor, 3/8- to 5/8-inch diameter, ICC ESR-2966, by DeWalt, Towson, MD.
4. Or equal with ICC Report Number.

E. Epoxy-Type Adhesive Anchors:
1. For fully grouted CMU
   a. HIT HY-70 by Hilti, ICC ER-2682.
   b. AC100+Gold by DeWalt, ICC ESR-3200
   c. Or equal with ICC Report Number.
2. For Normal Weight concrete with min. compressive of 2500 psi or 4000 psi.
   a. HIT-RE 500 V3 Adhesive Anchor System by Hilti, ICC ESR-3814.
   b. SET-XP adhesive by Simpson Strong-Tie, ICC ESR-2508
   c. Pure-110+ adhesive anchoring system for standard cure applications by DeWalt/Powers, ICC ESR-3298.
   d. AC200+ adhesive anchoring system for fast cure applications by DeWalt/Powers, ICC ESR-4027.
   e. Or equal with ICC Report Number.

F. Expansion-type anchors. Expansive type anchors may be used, provided the allowable shear and tension loads are determined by test in accordance with following:
1. The allowable values listed in an ICC-ES Evaluation Service Report, with special inspection, may be used for allowable stress design, provided the report states that the anchors were tested in accordance with AC 01, latest revision, including the seismic qualification tests of AC 01 Section 5.6. Strength design values may be used provided the anchors have been tested in accordance with AC193, latest revision, including the seismic qualification tests of ACI 355.2 Sections 9.6 and 9.7 and Annex 1 of AC-193.
2. For anchors installed in the underside of a beam/slab, the allowable tension load design values should be based on the tabulated value of the anchors installed without special inspection (special inspection is still required), unless allowable load values for anchors installed in cracked concrete are provided in the ICC-ES Report, or the anchors have been tested in accordance with ACI 355.2, latest revision, Table 5.2 and Annex 1 of AC-193, or ACI-318 Chapter 17A. Shear values are based on the tabulated values in the ICC-ES Report. Once an ICC-ES Report complying with AC-193 has been issued, it shall take precedence over any previous report.
3. If anchors have not been tested in accordance with the requirements for seismic qualification tests of AC 01, Section 5.6, the allowable load values listed in the ICC-ES Report may be used with the following modifications:
   a. Allowable shear and tension loads shall be limited to 80% of the tabulated allowable values for anchors installed with special inspection.
   b. For anchors installed in the underside of a beam/slab, the allowable tension load should be based on 80% of the tabulated allowable value for anchors installed without special inspection (special inspection is still required). Allowable shear values should be based on "a." above.
4. Underside of Beam/Slab Installations: except as noted in Section, all expansion type anchors installed in the underside of a beam/slab should use the reduced allowable design load values determined in F.1 and F3.b above.

a. The allowable design loads in F.1, F3.a above may be used for expansion-type anchors installed in the underside of a beam/slab, provided the installation meets one of the following criteria:
b. The design engineer provides information that indicates the anchor installation will occur in the negative moment (-M) region of the beam/slab, considering unbalanced loading, or
c. Data is submitted to indicate that specific anchor is suitable for use in cracked concrete (testing per ACI 355.2, Table 5.2, including Annex 1 of ACI 193), or
d. The anchor is installed in the high flute (rib) of the metal deck in a concrete on metal deck assembly, or
e. The anchor is installed with sufficient embedment that the load transfer zone is above the neutral axis of the beam/slab.
f. When installing expansion-type anchors through the low flutes of metal deck into concrete, the anchors should be placed as close to the center of the flute width as practicable. The deck shall be 20-gage minimum thickness per CBC Section 2210A.1.1.2 and the flute width shall meet or exceed the value set forth in the ICC-ES Report for the anchor. The minimum effective depth of embedment shall be as noted in the ICC-ES Report for the anchor.

G. Epoxy-type anchors. Epoxy-type (adhesive) anchors include anchors that rely on organic and inorganic compounds (including) epoxies, polyurethanes, methacrylates and vinyl esters) to develop the bond to the concrete.
1. The use of shallow epoxy-type (adhesive) anchors to resist direct tension loads where concrete cracking may occur is not permitted. Shallow epoxy-type (adhesive) anchors are those with an embedment to diameter ratio less than 8.
2. Epoxy-type (adhesive) anchors should only be installed in conditioned, interior spaces. Where epoxy type anchors are used as shear dowels at the perimeter of an existing opening (slab or wall) to be filled with concrete, or are being used to connect new concrete elements to existing concrete elements (e.g. gunite), they may be installed in exterior locations with prior approval by DSA.
3. If epoxy-type (adhesive) anchors are exposed to fire, all anchors in the affected area shall be inspected and evaluated by a qualified person to ensure their load carrying capability has not been compromised.
4. The design shear and tension capacities of epoxy-type anchors must be determined in accordance with the following:
   a. The allowable loads may be based on the values listed in an ICC ES Report that complies with requirements of AC 58 for a specific anchor in the same configuration as tested. Supporting data shall include the Seismic Qualification test performed in accordance with procedures of Section 5.3.7 of AC 58.
   b. Where epoxy-type (adhesive) anchors are used for structural applications, such as dowels between new and existing concrete the anchors shall be installed in a manner such as that the ultimate tensile capacity is controlled by the ultimate strength of the steel element.

H. When epoxy-type (adhesive) anchors are used to resist tensile forces in structural applications, the minimum depth of embedment shall be greater than or equal to the development length, ld, determined in ACI 318-14 for a cast-in-place reinforcing bar of the same diameter and grade when considering a tensile splitting failure mode. Where tensile splitting need not be considered, the depth of embedment, may be determined in accordance with Chapter 17 of ACI 318-14 as amended by Section 3.3 of AC 308.

I. Embedment, Spacing, and Edge Distance: All anchors shall meet the minimum embedment, spacing, edge distance, and slab thickness criteria established by the relevant ICC-ES Report.

J. Unless otherwise noted in the Report, the edge distance should be a minimum of ten (10) bolt diameters from the free edge of the slab and center-to-center spacing should be a minimum of twelve (12) bolt diameters. Holes shall be clean and free from dust immediately prior to installation of the anchor.

1.18 TESTING AND INSPECTION REQUIREMENTS FOR EXPANSION AND EPOXY ANCHORS

A. Post-installed anchors shall be tested in accordance with the provisions of CBC Section 1910A.5 by an accepted testing facility or Special Inspector. If any anchor fails testing, test all anchors of the same type, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency. If the anchors are used for the support and bracing of non-structural components (pipe, duct or conduit), the twenty (20) shall be only those anchors installed by the same trade. Refer to CBC Section 1910A.5.5 for acceptance/failure criteria.

B. Structural Applications: Test all expansion-type anchors. Expansion-type anchors shall not be used as hold-down bolts. When used for sill plate bolting application 10% of the anchors shall be tested.

C. Non-Structural Applications: Test 50% or alternate bolts including at least one-half the anchors in each group, shall be tested. in a group. Nonstructural may include such applications as equipment anchorage.

D. Testing shall be done in the presence of the project inspector and a report of the test results shall be submitted to DSA. If any anchors fail the testing requirements, the additional testing requirements shall be acceptable to DSA.. The requirements shall also apply to bolts or anchors set in concrete with chemical (adhesives) if the long-term curability and stability of the chemical material and its resistance to loss of strength and chemical change at elevated temperatures are established to the satisfaction of the DSA.

E. Expansion Type Anchors Setting Verification:
   1. Torque-Controlled Anchors: Following attainment of 10% of the required torque, torque-controlled anchors shall not require more than six (6) additional complete turns of the nut during installation to achieve the manufacturer's specified installation torque. The extent of bolt projection after installation shall be measured to confirm that this requirement has been meet.

2. Displacement-Controlled Anchors: The position of the plug in the anchor shell shall be checked with the manufacturer-supplied installation tool or other appropriate device. The position of the plug shall conform to the manufacturer's specifications.

F. Testing for Expansion-Type Anchors: The test load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, calibrated spring-loaded devices, or a calibrated torque wrench. Displacement-Controlled anchors such as drop-in shall not be tested using a torque wrench. Required test loads may be determined by either of the following methods:
   1. Twice the allowance tension load as determined in Article 1.18., or;
   2. Tension or torque test values from the table and procedures below.
   3. Anchors tested with a hydraulic jack should exhibit no discernable movement during the tension test, e.g., as evidenced by loosening of the washer under the nut. Anchors tested with a calibrated torque wrench must attain the specified torque within ½ turn of the nut.

G. Test Values: Conform to the following table for either Hardrock or Lightweight Concrete and Masonry:
   1. All anchor bolts of the expansion type installed in concrete shall be one of the following or equal:
      a. Hilti, Inc. - Qwik Bolt TZ2 - Wedge Anchor-ICC/ES ESR-4266.
      b. Simpson - Strong Bolt - Wedge Bolt - Wedge Anchor-ICC/ES ESR-3037.
      c. DeWalt/Powers - Power-Stud+SD2 - Wedge Anchor - ICC/ES ESR-2502.
   2. All anchor bolts of expansion type installed in grout filled masonry shall be one of the following or equal:
      a. Hilti, Inc - Kwik Bolt TZ2-Wedge Anchor-ICC/ES ESR-4561.
      b. Simpson-Wedge All-Wedge Anchor-ICC/ES ESR-1396.
      c. DeWalt/Powers - Power-Stud+SD1 - Wedge Anchor - ICC/ES ESR-2966.
   3. Anchor diameter refers to the thread size for the WEDGE ANCHORS.
   4. Reaction loads from test fixtures may be applied close to the anchor being tested, provided the anchor is not restrained from withdrawing by the fixture(s).
   5. Test equipment (including torque wrenches) shall be calibrated by an approved testing laboratory in accordance with standard recognized procedures.
   6. The following criteria apply for the acceptance of installed anchors:
      a. Hydraulic Ram Method: The anchor shall have no observable movement at the applicable test load. For wedge and sleeve anchors, a practical way to determine observable movement is that the washer under the nut becomes loose
      b. Torque Wrench Method: The applicable test torque must be reached within the following limit for wedge type:
         1) Wedge or Sleeve type: One-half (1/2) turn of the nut.
         2) One-quarter (1/4) turn of the nut for the 3/8-inch sleeve anchor only.
   7. Testing shall occur within 24 hours after installation.
   8. If the manufacturer's recommendation installation torque is less than the test torque listed in the table above, the manufacturer's installation torque shall be used in lieu of the tabulated values.

1.19 EPOXY-TYPE (ADHESIVE) ANCHORS AND SCREW-TYPE ANCHORS

A. Epoxy-type (adhesive) anchors shall be tension tested per Section 1910.A.5. The tension test load shall equal twice the allowable load for the specific location of the anchor to be tested (i.e., accounting for edge distance) or 80% of the yield strength of the bolt (0.8AbFy), whichever is less. The test procedures for expansion-type anchors in the attached table shall also be used for epoxy-type (adhesive) anchors. Torque testing of epoxy-type (adhesive) anchors is not permitted.

B. Where epoxy-type (adhesive) anchors are used as shear dowels across cold joints in slabs on grade and the slab is not part of the structural system, testing of those dowels is not required.

C. Anchors shall exhibit no discernible movement during the tension test.

D. Screw Anchors: The fastener is produced from hardened steel with threads, similar in appearance to a lag bolt. Screw anchors may be used, provided the allowable shear and tension loads are determined in accordance with the following:
   1. The allowable values listed in an ICC ES Report, with special inspection, may be used for allowable stress design, provided the report states that the anchors were tested in accordance with AC 106, latest revisions, including the seismic qualification tests of AC106 Section 4.6.
   2. Welding to these anchors is not permitted.
   3. Screw anchors may be used to attach components, such as equipment, mechanical vibration isolators or snubbers, to structural (reinforced) concrete, or for sill bolting applications. All screw anchors installed through a wood sill plate requires a plate washer in conformance with Section 2308.3.2.
   4. The use of screw anchors is not permitted in overhead applications or for discrete hold down forces, such as shear walls.
   5. Masonry Anchors: 1/4" diameter, Tapcon with Advance Threadform Technology, heat-treated steel, by Illinois Tool Works/Buildex, ICC-ESR-1671. Slotted Hex Washer Head.

E. Screw-type anchors shall be torque tested in accordance with the testing procedures in Test Values Table and procedures herein. 3/16", 1/4", Tapper+, Perma-Seal coating by DeWalt/Powers, ICC-ESR-3196. Slotted hex head and flat head.

F. Screw-type anchors: Simpson Strong-Tie Titen-HD concrete anchor, 3/8-, 1/2- and 3/4-inch diameter, ICC ESR-2713, by Simpson Strong-Tie, Pleasanton, CA or equal with ICC report number. DeWalt/Powers Screw-Bolt+ concrete anchor, 1/4- to 3/4-inch diameter, ICC ESR-3889, by DeWalt/Powers. Towson, MD.

G. Screw-type anchors: Simpson Strong-Tie Titen-HD grout-filled CMU anchor, 3/8-, 1/2-, 5/8-, and 3/4- inch diameter, ICC ESR-1056, by Simpson Strong-Tie, Pleasanton, CA or equal with ICC report number. DeWalt/Powers Wedge-Bolt+ grout-filled CMU anchor, 1/4- to 3/4-inch diameter, ICC ESR-1678, by DeWalt/Powers. Towson, MD.

1.20 POWDER ACTUATED FASTENERS

A. POWDER-Actuated Fasteners: POWDER-actuated fasteners (shot pins) are not addressed by Chapter 1901A.3 of CBC and ACI 318. POWDER-actuated fasteners may be used for limited application provided the allowable shear and tension loads are determined in accordance with the following:
   1. The allowable values listed in an ICC ES Evaluation Services Report, with special inspection, may be used for allowable stress design, provided the report states that the anchors were tested in accordance with AC 70, latest revision. POWDER-actuated fasteners may be used for hanging metal suspension systems for lay-in panel ceilings and for the attachment of metal track in conjunction with non-bearing partitions. The use of POWDER-actuated fasteners for other applications shall be subject to review and approval of DSA.

B. POWDER actuated fasteners (Shot Pins): Installer shall utilize tools recommended by the manufacture in compliance with the ICC code reports. Pins shall have a minimum diameter of 0.145 inch and be installed to conform to the load requirements of this Section and:
   1. Tables 1 (driven into steel), 2 (driven into concrete), and 4 (driven into Structural. lightweight concrete) of ICC ESR-1663, Hilti or
   2. Table 1 or 3 (driven into concrete), 2 (driven into steel), 5 (driven into structural lightweight concrete), and 6 (driven in hollow concrete masonry units) of ICC ESR-2138, Simpson Strong-Tie POWDER-actuated fasteners or
   3. Table 1 and 2 (driven into concrete), 3 (driven into structural lightweight concrete), 4 (driven into hollow concrete masonry units), 5 (driven into steel) of ICC ESR-2811, Simpson Strong-Tie gas-actuated fasteners or equal with ICC report.
   4. Table 1 (driven into concrete), 3 (driven into lightweight concrete and sand-lightweight concrete over steel deck), and 5 (driven into steel) of ICC ESR-2024, DeWalt/Powers POWDER-actuated fasteners.
   5. Table 3 (driven into concrete), 4 (driven into lightweight concrete and sand-lightweight concrete over steel deck), and 5 (driven into grouted / hollow concrete masonry units) 6,7 (driven into steel) of ICC ESR-3275, DeWalt/Powers gas-actuated fasteners or equal with ICC report.

C. Allowable Loads: Limited to 100 lbs. maximum or 80% of ICC approved values whichever is less. Testing required.

D. Use of POWDER actuated fasteners for tension loads is limited to support of minor loads such as suspended acoustical ceilings, ductwork and conduit. Permissible Loads for Ceiling Clip Assembly:
   1. Normal-Weight Concrete: Ceiling Clip Assembly Hilti X-CW, minimum 0.177" diameter, minimum penetration 1", unless noted otherwise. Allowable Loads and tension listed in ICC Report: ICC ESR 2184: 4000 psi Concrete Compressive Strength.
      a. Type X-CX ALH32 by Hilti, Inc., Tulsa, OK, or equal.
   2. Lightweight Concrete: Ceiling Clip Assembly, minimum 0.177" diameter, minimum penetration 1", unless noted otherwise. Required Allowable Loads and tension values listed in ICC ESR 2184: 3000 psi Concrete Compressive Strength.

a. Type X-CX ALH32 by Hilti, Inc., Tulsa, OK, or equal.

3. Use manufacture's drill bits and recommended tools.
4. Normal-Weight Concrete: Ceiling Clip Assembly DeWalt/Powers 0.3 Head Standard, minimum 0.145" diameter, min. penetration 1". Allowable loads: 100 lbs. tension listed in ICC Report: ICC ESR 2024: 4000 psi concrete compressive strength.
   a. 0.3" Head Standard, by DeWalt/Powers, Towson, MD, or equal.
5. Light-weight Concrete: Ceiling Clip Assembly, minimum 0.145" diameter, minimum penetration 1". Required Allowable Loads 60 lbs tension values listed in ICC ESR 2024: 3000 psi concrete compressive strength.
   a. 0.3" Head Standard by DeWalt/Powers, Towson, MD, or equal.
6. Use manufacturer's recommended tools.

E. Permissible Loads for Sills. Light gage steel and Interior Wood Plate Anchorages:
1. Low Velocity Power-Driven Fasteners: normal-weight concrete: Hilti DS and X-CR (stainless steel for exterior applications), 0.177", 0.145 for X-CR, shank diameter with washers, ICC-ESR Report ER-1663, Table 2. Exterior or Perimeter Sill and Interior Plate Anchorages.
2. Low Velocity Power-Driven Fasteners: normal-weight concrete: Simpson PDPWL-300, 3 inches long, 0.300-inch head diameter and 0.145 inch shank diameter with washer, ICC ESR-2138, Table 1 or 4. Exterior or Perimeter Sill and Interior Plate Anchorages.
3. Low Velocity Power-Driven Fasteners: normal-weight concrete: DeWalt/Powers: 0.3"- and 8-mm Head Drive Pins, 0.145", shank diameters with washers, ICC-ESR-2024, Table 7A. Wood Still Plate Anchorages

1.21 REQUIRED TESTING FOR POWDER ACTUATED FASTENERS

A. Testing: Operator, tool and fastener shall be pre-qualified by the Project Inspector.
1. Tools shall conform to ANSI A10.3 safety requirements for POWDER Actuated Fastening Systems and to all OSHA requirements.
2. Manufacturer's representative shall provide safety training for all installation personnel and provide POWDER actuated tool operator certification in accordance with OSHA requirements.

B. The Project Inspector shall observe the testing of the first 10 fastener installations.

C. A test pullout load of not less than twice the design load or 200 lbs., whichever is greater, shall be applied to the fastener in such a manner as not to resist the spalling tendency of concrete in which the fastener is imbedded. Thereafter, random tests under the Project Inspector's supervision shall be made of approximately 1 in 10 fasteners.

D. Should failure occur on any fastener tested, all installations shall be tested until twenty consecutive fasteners pass, then resume the initial testing frequency.

1.22 INSTALLATION

A. When installing drilled-in anchors or POWDER driven pins in reinforced concrete, use care and caution to avoid cutting or damaging reinforcing bars. When required by the Architect, locate the reinforcing by using a non-destructive method prior to installation. Exercise extreme care and caution to avoid cutting or damaging reinforcing during installation. Maintain a minimum clearance of one inch between the reinforcing and the anchor and/or pin.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 41 32

IMPORT MATERIALS TESTING

PART 1 – GENERAL

This Section specifies the requirements for the sampling, testing, transportation and certification of imported fill materials (i.e., earth materials, such as, soil, rock, crushed base, sand, compost, planter mix) to school sites.

1.01 SUMMARY

A. This Section defines:

1. CONTRACTOR submittal requirements.
2. CONTRACTOR requirements for use of existing or imported materials on school sites.
3. Testing requirements for all materials imported for use on a school site.
4. CONTRACTOR requirements for stockpiling materials for use on school sites.

1.02 OBJECTIVES

A. Ensure that fill materials imported to school sites are free of known and expected environmental contaminants for students, staff, and visitors.

B. Ensure that materials imported to school sites comply with any and all applicable California Code of Regulations (CCR), Code of Federal Regulations (CFR), California Environmental Protection Agency (Cal EPA), and Department of Toxic Substances Control (DTSC) requirements for school site use.

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

1.03 SUBMITTALS

CONTRACTOR shall submit to OWNER's Authorized Representative (OAR):

A. Within ten (10) 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 material. The list shall include estimated volumes required by each subcontractor and the intended borrow site locations each contractor intends to utilize. See 2.01B for pre-evaluated sites. If this ten (10) day timeframe is not met, the CONTRACTOR takes responsibility for possible delays associated with import testing.

B. Prior to the import of material from a District pre-evaluated site, the CONTRACTOR must provide a "Imported Materials Certification" form a minimum of ten calendar (10) days prior to needing material on site. The "Imported Materials Certification" form can be found at the end of this specification. Contractor shall be solely responsible for any schedule delay(s) and/or associated cost arising from pre-evaluated sites if this ten calendar (10) days timeframe is not met.

C. For a non-pre-evaluated site, CONTRACTOR must provide the same form a minimum of ten calendar (10) days prior to needing material on site. **Contractor shall be solely responsible for any schedule delay(s) and/or associated cost arising from import from non-pre-evaluated facilities.**

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

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

F. Certification, in the form of haul tickets or bill of lading, documenting the volume and recipient of all import materials and activities. This documentation shall be coordinated through the OAR. CONTRACTOR shall provide, track, and maintain a log of all imported materials

1. For approved import to school project sites, haul tickets will be utilized, and shall contain the following minimum information:
   - Date(s) of haul activity.
   - Address of source site.
   - Address of recipient.
   - Load volume.
   - Day of departure from source.
   - Day of arrival at recipient site.
   - Signature of recipient or recipient's agent.

1.04 APPROVALS

Import of soil, granular base, or geotechnical grading or filling materials at EL MONTE UNIFIED SCHOOL DISTRICT sites will occur ONLY with PRIOR approval of the Owners Representative for environmental considerations and the geotechnical professional assigned to the project CM team for geotechnical considerations.

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. Refer to part 2.01.B, of this Section, for the list of EL MONTE UNIFIED SCHOOL DISTRICT pre-evaluated sites.

3. Sands: Clean sand from a commercial source shall be tested pursuant to the requirements of this Section. Refer to part 2.01.B, of this Section, for the list of EL MONTE UNIFIED SCHOOL DISTRICT pre-evaluated sites. Plaster sand is included in this classification and must be tested per the requirements in this section.

4. Crushed Miscellaneous Base (CMB) per Section 200-2.4, fine sieve, of the Standard Specifications for Public Works Construction (Green Book). Prior to import, submit written certification to OAR that crushed Miscellaneous Base (CMB) does not contain Polychlorinated biphenyls (PCB) above laboratory detection limits when tested in accordance with EPA Method 8082.

B. Pre-Evaluated Sites:

Vulcan Materials Company
Vulcan Corona
1709 Sherbon Street
Corona, CA 92879
Materials Tested: SE-30 Sand, CAB, 3/4 " Rock

Vulcan Materials Company
Reliance Plant
16005 E Foothill Blvd.
Irwindale, CA 91702
Materials Tested: SE-30 Sand, CAB and ¾" Crushed Rock, 3/4" Class II Permeable Base, Washed Concrete Sand

Vulcan Materials Company
Durbin Sand and Gravel
13000 East Los Angeles Street
Irwindale, CA 91706
Materials Tested: Washed Plaster Sand, SE-30, ¾" Class II Permeable Base

All American Asphalt
1776 All American Way
Corona, Ca 92879
Materials Tested: CAB

Hanson Aggregates Irwindale
13550 Live Oak Lane
Irwindale, CA 91706
Tested Materials: CAB, Washed Plaster Sand, SE-30 Sand, ¾" Rock, and ¾" Class II Permeable Base

Materials at these facilities have been previously tested and approved.

PART 3 – EXECUTION

3.01 SAMPLING AND TESTING

A. CONTRACTOR must coordinate with the District per Item 1.03, of this Section, to request testing for a non-pre-evaluated site. **CONTRACTOR shall be solely responsible for any schedule delay(s) and/or associated cost arising from import from non-pre-evaluated facilities.** Please note, any request for turn-around time (TAT) less than 72-hours (business hours) will be rejected. District will make an attempt to honor faster TAT request; however, it is subject to availability of laboratory capacity, analytical method procedures, and field sampling personnel. CONTRACTOR's submission of a request for a faster TAT (for analytical results) should not be construed as District's approval for such requests. District shall not be liable in any way if such request could not be approved and/or honored.

B. The Contractor's Environmental Consultant shall perform testing of imported and site generated fill materials prior to importing and report results of all tests and shall furnish copies to the OAR, CONTRACTOR, Project Inspector, Architect, Contractor, DTSC, and/or others as required. **CONTRACTOR shall be solely responsible for the costs associated with the Environmental Consultant testing services.** Report shall state tests were conducted under the responsible charge of a licensed environmental professional (licensed State of California Professional Engineer [PE Civil], Professional Geologist [PG] or familiar with environmental site assessment and the material was tested in accordance with applicable provisions of the Contract Documents, CCR, CFR, DTSC, and DSA.

C. All fill/grading material must be tested at the site of origin. Owner (i.e., the District) retains the right to refuse import of fill material(s) from any particular site (even if it is pre-evaluated).

D. Import fill material may be deemed defective for use by EL MONTE UNIFIED SCHOOL DISTRICT at a school site if any of the following results are obtained:

1. Total petroleum hydrocarbons (TPH) are present at concentrations exceeding 10 milligrams per kilogram (mg/kg) for gasoline range organics, and/or 100 mg/kg for diesel range organics, and/or 500 mg/kg for oil range organics.
2. Solvents and other volatile organic compounds (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. Polychlorinated Biphenyl (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. Semi volatile organic compounds (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. Organochlorine Pesticides (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. 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.
7. 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.
8. Hexavalent chromium is present at concentrations exceeding 15 mg/kg or failing hazardous waste STLC leachate criteria.

E. Specification test results and EL MONTE UNIFIED SCHOOL DISTRICT 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 EL MONTE UNIFIED SCHOOL DISTRICT.

F. Import fill materials shall be stockpiled by CONTRACTOR (or the facility) at the site from where material is proposed to be imported, and are deemed acceptable for import only when it is demonstrated to the satisfaction of EL MONTE UNIFIED SCHOOL DISTRICT that the subject materials meet the requirements of this Section.

G. Apply appropriate dust control measures to prevent dust generation from import stockpiles/materials; and be compliant with appropriate rules and regulations prescribed by the South Coast Air Quality Management District. Maintain dust control measures at all times and under all environmental conditions. Contractor generating stockpile shall be held fully responsible for any violation(s) arising out of non-compliance related to air quality issues associated with the stockpile.

H. Apply appropriate storm water pollution prevention best management practices (BMPs) on and around the imported stockpiles. Contractor generating stockpile shall be held fully responsible for any violation(s) arising out of non-compliance related to storm water pollution issues associated with the stockpile.

3.02 TRANSPORTATION

A. Details of the samples and testing must be approved by EL MONTE UNIFIED SCHOOL DISTRICT 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, DTSC, etc.).

3.03 COSTS

A. Contractor will incur the costs of testing for pre-evaluated sites identified in 2.01B.

B. CONTRACTOR shall pay all fees for testing any non-pre-approved site. CONTRACTOR shall be solely responsible for any schedule delay(s) associated with testing any non-pre-approved site.

C. CONTRACTOR shall pay all fees for loading, hauling, and importing fill materials identified in the contract documents.

D. If fill material is imported from any site without prior written approval from EL MONTE UNIFIED SCHOOL DISTRICT and/or from a previously un-evaluated source(s), CONTRACTOR shall remove such material from the District's site at their own cost immediately upon discovery of such. Any delay in removal of such material may incur liquidated damages for each day such violation continues. In addition, under such scenario the EL MONTE UNIFIED SCHOOL DISTRICT Environmental Consultant may collect necessary samples from the area(s) where the said material has been placed (if deemed necessary). All costs associated with such (including sampling, testing, further delineation, removal and disposal of impacted materials, field oversight, consulting, legal charges, and regulatory oversight fees) efforts shall be the CONTRACTOR's sole responsibility.

TABLE 1: MINIMUM SAMPLING FREQUENCY

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

IMPORTED MATERIALS CERTIFICATION

This form shall be executed by Contractor and by all entities that, in any way, provide or deliver and/or supply any soils, aggregate, or related materials ("Fill") to the Project Site(s). All Fill shall satisfy the requirements of any environmental review of the Project performed pursuant to the statutes and guidelines of the California Environmental Quality Act, section 21000 et seq. of the Public Resources Code ("CEQA"), and the requirements of section 17210 et seq. of the Education Code, including requirements for a Phase I environmental assessment acceptable to the State of California Department of Education and Department of Toxic Substances Control.

To the furthest extent permitted by California law, the indemnification provisions in the Contract Documents apply to, without limitation, any claim(s) connected with providing, delivering, and/or supplying Fill.

Certification of:	□ Delivery Firm/Transporter	□ Supplier	□ Manufacturer
	□ Wholesaler	□ Broker	□ Retailer
	□ Distributor	□ Other _____	
Type of Entity:	□ Corporation	□ General Partnership	
	□ Limited Partnership	□ Limited Liability Company	
	□ Sole Proprietorship	□ Other _____	

Name of firm ("Firm"): _____

Mailing address: _____

Addresses of branch office used for this Project: _____

If subsidiary, name and address of parent company: _____

By my signature below, I hereby certify that I am aware of section 25260 of the Health and Safety Code and the sections referenced therein regarding the definition of hazardous material. I further certify on behalf of the Firm that all soils, aggregates, or related materials provided, delivered, and/or supplied or that will be provided, delivered, and/or supplied by this Firm to the Project Site(s) are free of any and all hazardous material as defined in section 25260 of the Health and Safety Code. I further certify that I am authorized to make this certification on behalf of the Firm.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

In addition to the requirement to provide this certification, Contractor agrees that it shall provide all documentation requested by the District to confirm compliance with the requirements herein.

END OF SECTION

SECTION 01 57 13

STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparation, implementation and monitoring of Storm Water Pollution Prevention Plan (SWPPP) for the purpose of preventing the discharges of pollutants from the construction site into the receiving waters. This includes elimination of non-storm water pollution discharges such as improper dumping, spills or leakage from storage tanks or transfer areas.

B. Compliance with all local, state and federal regulations governing storm water discharges associated with construction activities such as, but not limited to clearing, excavating, grading, demolition and other land disturbances.

C. Payment of application and annual fees required by the State Water Resources Control Board (SWRCB) for the duration of the construction of the Project.

D. Submittal of all Permit Registration Documents (PRDs) through the SWRCB SMARTS online system.

E. Certification that the construction project has met all of the conditions of the General Construction Storm Water Permit (GCSWP).

1.02 REFERENCES

A. National Pollutant Discharge Elimination System (NPDES) General Permit No CAS000002.

B. State Water Resources Control Board (SWRCB) Water Quality Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ.

C. California Stormwater Quality Association, Stormwater Best Management Practice Handbook, Construction, latest edition.

1.03 RELATED DOCUMENTS

A. Project Contract, including General, Special and Supplementary Conditions and other General Requirements.

1.04 ACRONYMS AND DEFINITIONS

BMP	Best Management Practice.
CAN	Corrective Action Notice.
CASQA	California Stormwater Quality Association.
COI	Change of Information.

DWQ	Division of Water Quality.
CGP	NPDES General Permit for Storm Water Discharges Associated with Construction Activities.
ELAP	Environmental Laboratory Accreditation Program.
LRP	Legally Responsible Person (OWNER).
NOI	Notice of Intent.
NOT	Notice of Termination.
NPDES	National Pollutant Discharge Elimination System.
OEHS	LAUSD Office of Environmental Health and Safety.
PRDs	Permit Registration Documents, including NOI, Risk Assessment, Site Map, SWPPP, Annual Fee, Signed Certification Statements.
REAP	Rain Event Action Plan.
RISK LEVEL	As defined by CGP.
QSD	Qualified SWPPP Developer.
QSP	Qualified SWPPP Practitioner.
QRE	Qualifying Rain Event, is an event that produces 0.5 inches of precipitation with a 48 hour or more period between rain events.
SMARTS	Storm Water Multiple Application and Report Tracking System (smarts.waterboard.ca.gov).
SWPPP	Storm Water Pollution Prevention Plan.
SWRCB	State Water Resources Control Board.
WPCD	Water Pollution Control Drawings.
WDID	Waste Discharge Identification Number.

1.05 SUBMITTALS

A. Contractor's QSD shall submit the Notice of Intent and all Permit Registration Documents and the Notice of Intent fee required by SWRCB.

B. Contractor's QSD shall prepare and submit the Storm Water Pollution Prevention Plan for this project to the State Water Resources Control Board (SWRCB) via SMARTS.

C. The Contractor's QSD shall prepare the SWPPP, including the WPCD, Risk Level Determination, and Post Construction Water Balance Calculation. Copies of these documents shall be provided to the Contractor. Contractor at his discretion may accept SWPPP as is, modify it, or develop his own.

D. Contractor shall submit qualifications and experience of the QSD & QSP for Owner's review and acceptance.

E. Contractor shall submit electronic copies of weekly and quarterly inspections, annual reports, compliance certifications, and test results.

F. Contractor shall submit the annual report. The General Permit requires all projects that are enrolled for more than one continuous three-month period to submit information and annually certify that their site is in compliance with these requirements. All dischargers must prepare and electronically submit an annual report no later than September 1 of each year using the Storm water Multi-Application Reporting and Tracking System (SMARTS). The Annual Report must include a summary and evaluation of all sampling and analysis results, original laboratory reports, chain of custody forms, a summary of all corrective actions taken during the compliance year, and identification of any compliance activities or corrective actions that were not implemented.

G. Within 90 days of when construction is complete or ownership has been transferred, the Contractor shall electronically file a Notice of Termination (NOT), a final site map, and photos through the State Water Boards SMARTS system. Filing a NOT certifies that all General Permit requirements have been met.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Storm Water Pollution Prevention Plan: The Contractor's QSD shall provide the quality, grade and type of materials as specified in Stormwater Best Management Practice Handbook, Construction, latest edition, and State Water Resources Control Board (SWRCB) Water Quality Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ.

B. The Contractor shall have available on-site during construction activities a non-stormwater sampling kit suitable for obtaining storm water and non-stormwater quality grab samples. Kit shall include containers and preservatives appropriate for the pollutants known or expected to be in the stormwater. Required sampling equipment shall be adequate to capture and transport samples to a local ELAP State certified water testing lab.

C. Provide a rain gauge on site to record readings during site inspections.

PART 3 - EXECUTION

3.01 SWPPP IMPLEMENTATION

A. The Contractor shall hire a Qualified SWPPP Practitioner (QSP), as defined by the Construction General Permit, to implement the Storm Water Pollution Prevention Plan to be consistent with the requirements of SWRCB Water Quality Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ, and as follows:

1) Install perimeter controls and sediment control BMPs prior to starting construction work at the site.

2) Install effective erosion control BMPs at the jobsite.

3) Protect exposed dirt, such as stockpiles, landscaping areas, and hillsides.

4) Properly manage non-storm water discharges such as ground water, broken utility lines and fire hydrant testing per CGP requirements.

5) Contain on-site storm water at the jobsite. Do not drain on-site water directly into the storm drains.

6) QSP to train personnel for the proper implementation of the SWPPP.

7) Revise the SWPPP to suit changing site conditions and also when properly installed systems are ineffective.

8) Adjust BMP's locations and layouts in accordance to construction progress to assure compliance to regulations.

9) Conduct inspections of pollution prevention controls and provide Site Monitoring Report to OAR immediately if pollutants are discharged into the site runoffs. CONTRACTOR shall sample and remediate contaminated water.

10) QSP to develop and implement Rain Event Action Plans (REAPs).

11) QSP to perform and oversee all monitoring consistent with the identified Risk Level for the site.

12) Notification and Report: If pollution occurs in the work area for any reason or when the Contractor becomes aware of any violation of this Section, correct the problem and immediately notify the Inspector. In addition, submit a written report to the Project Civil Engineer within seven (7) calendar days describing the incident and the corrective actions taken. If either the Inspector or Engineer is first to observe pollution or a violation, the Contractor shall also explain in the written report why the Work was inadequately monitored.

13) Revise SWPPP to suit changing site conditions and also when properly installed systems are ineffective.

14) Upon Substantial Completion: Maintain and leave post-construction storm water pollution prevention controls in place and remove those that are not needed as determined by the QSD and OAR.

15) QSP shall submit the annual report. All dischargers must prepare and electronically submit an annual report no later than September 1 of each year using the Storm water Multi-Application Reporting and Tracking System (SMARTS). The Annual Report must include a summary and evaluation of all sampling and analysis results, original laboratory reports, chain of custody forms, a summary of all corrective actions taken during the compliance year, and identification of any compliance activities or corrective actions that were not implemented.

3.02 MONITORING

A. The Contractor shall conduct examination of storm water pollution prevention controls according to the monitoring requirements identified for the projects risk level as defined by the Construction General Permit.

B. The Contractor shall prepare and maintain, at the jobsite, a log of each inspection using Site Monitoring Report forms.

C. The Contractor shall distribute copies of the Owner provided Storm Water Pollution Prevention Plan to their superintendent and subcontractors. At least one (1) copy of the SWPPP shall be available on site at all times.

3.03 SWPPP LIABILITIES AND PENALTIES

A. Review of the inspection logs by the Owner shall not relieve the Contractor from liabilities arising from non-compliance with storm water pollution regulations.

B. Payment of Penalties for non-compliance by the Contractor shall be the sole responsibility of the Contractor and will not be reimbursed by the Owner.

C. Compliance with the Clean Water Act and the State Water Resources Control Board (SWRCB) Water Quality Order 2009-0009-DWQ pertaining to construction activities is the sole responsibility of the Contractor. For any fine(s) levied against the Owner due to non-compliance by the Contractor, the Owner will have the option to either require payment by Contractor of, or deduct from any payments due the Contractor, the total amount of the fine(s) levied on the Owner and associated costs.

3.04 SWPPP CLOSEOUT

A. Verify the following prior to Substantial Completion of SWPPP:

1) Elements of the SWPPP have been completed.

2) Final stabilization of site, as defined by the GCP, has been demonstrated.

3) There is no potential for construction related storm water pollutants to be discharged into site runoff.

4) Construction related equipment and temporary BMPs have been removed from site.

5) Rubbish, debris, and waste materials have been removed and legally disposed of off the Project site.

6) Post-Construction BMP Maintenance Plan has been established.

END OF SECTION

SECTION 01 71 23

FIELD ENGINEERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surveying requirements for the Work.

1.02 RELATED SECTIONS

A. Section 31 20 00: Earthwork

B. Section 32 12 16: Asphalt Paving

C. Section 33 40 00: Storm Drainage

1.03 SURVEY SERVICE

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

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 SUBMITTALS

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

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

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

3.02 LAYOUT OF THE WORK

A. CONTRACTOR shall employ a State of California licensed surveyor to lay out the entire Work, set grades, lines, levels, control points, vertical and horizontal control, elevations, grids and positions. Before the commencement of Work, surveyor shall, in conjunction with OWNER and Construction Management Representative (CMR) provided engineering survey of the Project site, locate all

reference points and benchmarks, then lay out all lines, elevations, and measurements for the entire Work including but not limited to, buildings, grading, paving and utilities.

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

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

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

3.03 SURVEY REQUIREMENTS

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

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

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

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

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

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

G. Provide adequate horizontal and vertical control to locate utility lines, including but not limited to, storm, sewers, water mains, gas, electric and signal and provide vertical control in proportion to the slope of the line as required for accurate construction. Dry utilities will be based upon adequate horizontal and vertical control layout. Prior to trench closure, survey and record invert and flow line elevations. Survey and record top of curb and flow line elevations on finished concrete or AC surfaces at key locations such as BC’s, EC’s, grade breaks, corners or angle points in sufficient number to demonstrate the Work complies with the intent of the Contract Documents.

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

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

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

3.04 ESTABLISHMENT OF GRADES IN PLAY FIELD AREAS

A. Provide Grading Plan and Final survey: Prior to turf installation, a grade verification survey shall be performed. Final grade verification shall consist of site survey conducted by the Owner's surveyor consisting of a 20 ft. x 20 ft. grid. Additional planarity verification shall consist of string line and 10 ft strait edge checks at random over entire area which has been prepared for synthetic turf. Contractor shall immediately remediate any areas found not to meet specification.

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

3.05 ESTABLISHMENT OF GRADES IN HARDSCAPE AREAS

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

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

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

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

3.06 STORM DRAIN & SEWER PIPE INSTALLATION

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

3.07 RECORD DRAWINGS

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

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

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

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

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Preparation and implementation, including reporting and documentation, of a Waste Management Plan for reusing, recycling, salvage or disposal of non-hazardous waste materials generated during demolition and/or new construction (Construction & Demolition (C&D) Waste), to foster material recovery and re-use and to minimize disposal in land fills.

1.02 REFERENCES

A. California Integrated Waste management Act of 1989 (AB 939).

B. California Code of Regulations Title 14, Section 18700.

C. California Green Building Standards Code, "CalGreen", Title 24, Part 11.

1.03 ACTION SUBMITTALS

A. Waste Management Plan (Appendix A): Within 10 calendar days after the Notice to Proceed and prior to any waste removal, submit the following to the Architect for review and approval. Update quarterly. Include:
   1. Materials to be recycled, reused, or salvaged, either onsite or offsite.
   2. Estimates of construction waste quantity (in tons) by type of material. (If waste is measured by volume, give factors for conversion to weight in tons.)
   3. Procedures for recycling/ reuse program.
   4. Permit or license and location of Project waste-disposal areas.
   5. Site plan for placement of waste containers.

B. Waste Management Monthly Progress Report (Appendix B): Summary of waste generated by Project, monthly with Application for Payment. Include:
   1. Firms accepting the recovered or waste materials.
   2. Type and location of accepting facilities (landfill, recovery facility, used materials yard, etc.). If materials are reused or recycled on the Project site, location should be designated as "on-site reuse / recycling".
   3. Type of materials and net weight (tons) of each.
   4. Value of the materials or disposal fee paid.
   5. Attach weigh bills and other documentation confirming amount and disposal location of waste materials.

C. Waste Management Final Compliance Report: Final update of Waste Management Plan to provide summary of total waste generated by Project.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Collection and separation of all construction waste materials generated on-site, reuse or recycling on-site, transportation to approved recyclers or reuse organizations, or transportation to legally designated landfills, for the purpose of recycling salvaging and/or reusing a minimum of 65% of the construction waste generated.

PART 3 - EXECUTION

3.01 IMPLEMENTATION

A. Implement approved Waste Management Plan including collecting, segregating, storing, transporting and documenting each type of waste material generated, recycled or reused, or disposed in landfills.

B. Designate an on-site person to be responsible for instructing workers and overseeing the sorting and recording of waste/recyclable materials.

C. Include waste management and recycling in worker orientation and as an agenda item for regular Project meetings.

D. Recyclable and waste bin areas shall be limited to areas approved on the Waste Management Plan. Keep recycling and waste bins neat and clearly marked to avoid contamination of materials.

3.02 ATTACHMENTS

A. Appendix A: Waste Management Plan

B. Appendix B: Waste Management Monthly Progress Report

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

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

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

B. Disposal: Removal off-site of demolition waste and subsequently deposit in landfill acceptable to authorities having jurisdiction.

C. Existing to Remain: Items of construction that are not to be removed and that are not indicated to be removed.

1.3 MATERIALS OWNERSHIP

A. Historic items, relics, cornerstones, commemorative plaques, tablets and similar objects encountered during demolition are to remain the Owner's property.

B. Carefully remove each item in a manner to prevent damage and deliver to Owner.

1.4 SUBMITTALS

A. Predemolition Photographs: Show conditions of exiting adjacent construction and site improvements that might be misconstrued as damaged by demolition operations. Submit before work begins.

B. Record Documents: Accurately record locations of utilities and subsurface obstructions.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable codes for demolition work, safety of structure, electrical disconnection and reconnection dust control and disposal of materials.

B. Comply with California Fire Code (CFC), California Code of Regulations, (CCR) Title 24, Part 9, Chapter 14 - Fire Safety During Construction and Demolition.

C. Obtain required permits from authorities.

D. Notify affected utility companies before starting work and comply with their requirements.

E. Do not close or obstruct egress width to exits.

F. Do not disable or disrupt building fire or life safety systems without 3 day prior written notice to the Owner.

1.6 PROJECT CONDITIONS

A. Areas of buildings to be demolished will be evacuated and their use discontinued before start of work.

B. Owner will occupy building(s) adjacent to demolition area. Conduct demolition so owner's operation will not be disrupted.

C. Provide at least 72 hour notice to Owner of activities that will affect

Owner's operation.

D. Maintain access to existing walkways, exits and other adjacent

occupied facilities.

E. Owner assumes no responsibility for areas of buildings to be demolished.

F. Hazardous Materials: It is not anticipated that hazardous materials will be encountered in the work.

1. Hazardous materials will be removed by Owner before start of work.

2. Hazardous materials will be removed by Owner under separate contract.

3. If materials suspected of containing hazardous materials are encountered, do not disturb. Notify Architect.

4. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

1.7 SEQUENCING

A. Owner will conduct salvage operations before demolition begins to remove materials and equipment that the Owner chooses to retain.

B. Notify Owner in writing 5 days in advance of any required work to be performed on

a weekend or holiday.

C. Coordinate utility and building service interruptions with Owner.

D. Schedule tie-ins to existing systems to minimize disruption.

E. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.9 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Architect. Do not resume operations until directed.

3. PART 3 - EXECUTION

3.1 EXAMINATION

A. Correlate existing conditions with requirements indicated.

B. Inventory and record condition of items to be removed

and salvaged. Execute predemolition photographs.

D. Verify that hazardous waste remediation is complete.

3.2 PREPARATION

A. Existing Utilities: Locate, identify, disconnect and seal or cap off indicated utilities serving areas to be demolished.

B. Salvaged Items: Clean, pack and identify items for delivery to Owner.

C. Protect existing items which are not indicated to be salvaged,

removed, or altered.

D. Erect and maintain weatherproof closures for exterior openings.

E. Erect and maintain temporary partitions to prevent spread of dust, fumes, noise, and smoke to provide for Owner occupancy.

3.3 DEMOLITION

A. Conduct demolition to minimize interference with adjacent [and occupied] building areas.

B. Cease operations immediately if structure appears to be in danger. Notify Architect. Do not resume operations until directed.

C. Maintain protected egress and access to the Work.

D. Maintain fire safety during demolition in accordance with CFC, Chapter 14.

E. Demolish in an orderly and careful manner. Protect existing supporting structural members.

3.4 SALVAGING OF DEMOLITION

MATERIALS

A. Clean salvaged items.

B. Pack or crate items after cleaning. Identify

contents.

C. Store items in secure area until delivery to

Owner.

D. Protect items from damage.

E. Install salvaged items to comply with requirements for new materials and equipment.

3.5 RECYCLING OF DEMOLITION MATERIALS

A. Separate recycled demolition materials from other demolished materials.

B. Stockpile processed materials on-site without intermixing with

other materials.

C. Do not store materials within drip line of trees

D. Transport recyclable materials that are not indicated to be reused off Owner's property to recycling receiver or processor.

E. Recycled incentives received for building demolition materials shall be equally shared between Contractor and Owner.

F. Wood Materials: Sort and stack members according to size, type and length. Separate dimensional and engineered lumber, panel products, and treated wood materials.

G. Metals: Separate by metal type. Remove nuts, bolts and rough hardware. Sort structural steel by type and size.

H. Roofing: Separate organic and fiberglass shingles and felts. Remove nails, staples

and accessories.

I. Doors and Hardware: Brace open end of door frames. Leave hardware attached to doors.

J. Carpet and Pad: Store clean dry carpet and pad in a closed container or trailer.

K. Gypsum Board: Stack large clean pieces on pallets. Remove edge trim and sort with metals. Remove and dispose of fasteners.

L. Acoustical Ceiling Materials: Stack panels and tiles on pallets. Separate suspension system and sort with metals.

M. Equipment: Drain tanks, piping and fixtures. Seal openings with caps or plugs.

N. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves and other components.

O. Lighting Fixtures: Remove lamps and separate by type.

P. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

Q. Conduit: Reduce conduit to straight lengths and store by type and size.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Except for items to be salvaged, reinstalled, or otherwise indicated to remain, remove demolished materials from Project site and legally dispose of them in an EPA – approved landfill.

B. Do not burn or bury materials on site.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition.

B. Remove temporary construction.

C. Return adjacent areas to condition existing before demolition operations began.

D. Leave site in a clean condition.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

E. Related Sections:
   1. Section 03 20 00, Concrete Reinforcement.
   2. Section 03 30 00, Cast-In Place Concrete.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

C. ACI 347R - Guide for Shoring/Reshoring of Concrete Multistory Buildings.

D. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

E. PS-1 - Construction and Industrial Plywood.

F. California Code of Regulations, Title 8 Subchapter 4. Construction Safety Orders, Article 29, Erection and Construction, Section 1717.

G. Chapter 19A, 2019 California Building Code.

H. APA - American Plywood Association Design and Construction Guide.

I. CCR - California Code of Regulations, Title 8, Subchapter 4, Construction Safety Orders.

J. Local AQMD - Air Quality Management District.

1.03 COORDINATION

A. Coordinate this Section with other Sections of work that require attachment of components to formwork.

B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

PART 2 - PRODUCTS

2.01 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to Section 26.11, ACI 318. Resultant concrete to conform to required shape, line and dimension. Design of formwork is Contractor's responsibility.

B. The formwork shall be designed for the loads and lateral pressures outlined in Chapter 2 of ACI 347R, and lateral forces as specified by the CBC.

C. Forms shall be designed by a professional Civil engineer registered in the State of California.

D. Foundation concrete may be placed directly into neat excavations, provided foundation trench walls are stable as determined by Architect, subject to approval of DSA and Architect. In such case, minimum formwork indicated on drawings is mandatory to insure clean excavations immediately prior to and during placing of concrete.

2.02 FORM MATERIALS

A. Plywood: APA - MDO (Medium Density Overlay) Plyform, Group 1, Exterior, PS-1, for exposed surfaces. APA - BB (No-overlay) Plyform, Class 1, Exterior, PS-1 for unexposed surfaces.

B. Lumber: Douglas Fir species; construction grade with grade stamp clearly visible.

C. Form Ties: Removable metal of adjustable length, cone ends.

2.03 FORMWORK ACCESSORIES

A. Form Release Agent: Colorless non-staining liquid chemical agent, free of wax or oils which will not absorb water. Material shall comply with Local AQMD.

B. Corners: Chamfered type; maximum possible lengths.

C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements in accordance with requirements of ACI 318 Section 26.11.
   1. Calculations Required: Provide shoring required to protect all earth banks which cannot be sloped back, due to adjacent structures, walks, streets or property lines. Provide engineering calculations and drawings necessary to perform Work. Calculations to be sealed and signed by licensed California Structural Engineer.
   2. Where public areas such as sidewalks and streets are to be shored, drawings and calculations are to be submitted by Contractor to the city or governing agency for approval prior to beginning of any work.
   3. Contractor and/or his engineer assume and accept all responsibility for construction and safety of shoring.
   4. Upon completion of Work, shoring materials are to be removed from site at expense of Contractor. Certain steel and/or concrete materials may be left in place with written approval of Architect.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Form Board Joint and Tie-Hole Patterns
   1. Form Boards shall be uniform in size, as required per the Drawings.
   2. Coordinate form-board lay-out and tie-patterns with architectural features and building module. Board pattern and tie-spacing shall be symmetrical in each surface and accurately aligned unless shown otherwise.
   3. Make form-board joints grout-tight to prevent leakage of concrete.
   4. Locate form ties in a symmetric pattern within each form-board panel and accurately aligned from panel to panel.
   5. Locate construction joints in a manner that will not impair strength and will have least impact on appearance, as acceptable to the Architect.
   6. Seal form joints and penetrations watertight with gaskets and/or sealant in compliance with the manufacturer’s printed instructions.

D. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shoring. Conform to Title 8, Subchapter 4, Construction Safety Orders, CCR.

E. Align joints and make watertight. Keep form joints to a minimum.

F. Obtain approval before framing openings in structural members that are not indicated on Drawings.

G. Provide chamfer strips on external corners.

H. Surface irregularities, ACI 347R Class A, gradual or abrupt irregularities of 1/8 inch for exposed to view concrete. Class B, 1/4 inch for plaster cement finish.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work. No openings or embedded items permitted in structural slabs within 18 inches of columns. Conform to Section ACI 318 Section 26.11.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors and other inserts, whether indicated on the structural drawings or not.

D. Install accessories in accordance with manufacturer's instructions, straight, level and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117.

3.08 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design and that supports, fastenings, wedges, ties and items are secure.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads. Conform to Chapter 26, Section 26.11, ACI 318.
   1. Minimum stripping time for walls and columns: 5 days.
   2. Minimum stripping time for beams and structural slabs: 21 days.

B. Loosen forms carefully. Do not wedge pry bars, hammers or tools against finish concrete surfaces scheduled for exposure to view. Do not break-off corners.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms. Re-shoring permitted only after 10 days and prior to stripping.

3.10 FINISH AT ALL EXPOSED SURFACES

A. Rubbed Finish: Apply the following to Smooth-Formed Finished concrete per ACI 301:
   1. Grout-Cleaned Finish (Sack-rubbed finish): Remove fins, rough spots, stains, and hardened mortar by carefully rubbing with a fine abrasive stone to a smooth even surface. Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fabricating and setting reinforcing steel and accessories for cast-in-place concrete.

B. Related Sections:
   1. Section 03 10 00, Concrete Formwork.
   2. Section 03 30 00, Cast-in-Place Concrete.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ACI 315 - Details and Detailing of Concrete Reinforcing.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

D. ASTM International:
   1. ASTM 1064 - Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   2. ASTM A615 - Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
   3. ASTM A706 - Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

E. AWS D1.4 - Structural Welding Code for Reinforcing Steel.

F. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.

G. Chapter 19A, 2019 California Building Code.

1.03 SUBMITTALS

A. Shop Drawings, indicating bar sizes, spacings, locations and quantities of reinforcing steel bending and cutting schedules and supporting and spacing devices.

1.04 QUALITY ASSURANCE

A. Provide Testing Laboratory with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

B. Comply with the requirements of Division 01, General Requirements.

1.05 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 - PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, deformed billet steel bars, in grades as follows, and conforming to CBC 19A, Section 1903A.
   1. For No.4 and larger bars, use 60 ksi yield grade.
   2. For ties and stirrups, and No. 3 and smaller bars, use 40 ksi yield grade.
   3. For welded bars, use ASTM A706 60 ksi yield grade.

B. Welded Wire Reinforcement: Plain type, ASTM A1064; in flat sheets; uncoated finish, 6 x 6 - W4.0 x W4.0 unless otherwise noted on drawings.

C. Welding Electrodes: Low Hydrogen grade E7018 for Grade 40, E80XX for Grade 60.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16-gauge black annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

D. Concrete Blocks: Approximately 3 inches dimension each side.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice, ACI 315 and ACI 318. Wherever possible, make bends to shape in fabricator's shop.
   1. Bars reduced in section will not be accepted.
   2. Bars with kinks are unacceptable.

3. Bars shall not be heated to facilitate bending or for any other purpose.
4. Bars with bends not indicated on drawings will not be accepted. Perform no forming in a manner which will damage bars.
5. Rebending of bars prohibited.

B. Weld reinforcement in accordance with AWS D1.4.

C. Locate reinforcing splices not indicated on Drawings at point of minimum stress.

PART 3 - EXECUTION

3.01 PLACEMENT

A. General: Comply with CBC and CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Place, support and secure reinforcement against displacement. Do not deviate from required position. Install concrete blocks to support reinforcement over grade. Rocks not permitted.

C. Do not displace or damage vapor barrier where vapor barrier is specified or indicated on drawings. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

D. Accommodate placement of formed openings.

E. Prior to placing, thoroughly clean reinforcement of all rust, dirt, dust, oil or any other material deleterious to bonding of concrete.

F. Accurately place and securely tie reinforcement with black annealed wire and securely hold in position during placing of concrete by means of precast concrete block supports. Point wire tie ends away from the form. Unless otherwise indicated, the number, type, and spacing of supports shall conform to the ACI 315.
1. Tie reinforcement splices and intersections per CBC and CRSI, Chapter 10, General Principles for Placing, Splicing and Tying Reinforcing Bars.

G. During placing of structural concrete slabs, provide a full-time reinforcing steel placer to repair and replace reinforcing to its proper location. Provide additional chairs of the proper size available to place under bars displaced during the concrete pouring operation.

H. Dowels for Walls: Securely tie in place prior to placing of concrete. Do not place dowels in concrete after pour.

I. Conform to Section 20.6.1.3.1, ACI 318, California Building Code for concrete cover over reinforcement.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete.

B. Concrete curbs for walls, floors and slabs on grade, footings.

C. Control, expansion and contraction joint devices associated with concrete work including joint sealants.

D. Concrete for curbs, gutter, sidewalks, stairs and ramps and other site-related concrete is specified in Division 32.

E. Related Sections:
   1. Section 03 10 00, Concrete Formwork.
   2. Section 03 20 00, Concrete Reinforcement.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of Contract Documents.

B. CBC - 2019 California Building Code
   1. CBC Chapter 19A, Concrete

C. ADA - Americans with Disabilities Act of 1990, as amended
   1. ADA Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

D. American Concrete Institute:
   1. ACI 224R - Control of Cracking in Concrete Structures.
   2. ACI 224.3R - Joints in Concrete.
   3. ACI 301 - Structural Concrete for Buildings.
   4. ACI 318 - Building Code Requirements for Structural Concrete and Commentary

E. ASTM International:
   1. ASTM C33 - Concrete Aggregate.
   2. ASTM C150 - Portland Cement.
   3. ASTM C171 - Sheet Materials for Curing Concrete.
   4. ASTM C 311 - Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

5. ASTM C618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete.
6. ASTM C856 - Petrographic Examination of Hardened Concrete.
7. ASTM C1107 - Packaged Dry, Hydraulic - Cement Grout (Nonshrink).
8. ASTM E1155 - Standard Test Method for Determining Floor Flatness and Levelness using the F-Number System.
9. ASTM C567 - Unit Weight of Structural Lightweight Concrete.
10. ASTM C1116 - Specification for Fiber-Reinforced Concrete.
11. ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Bituminous Type).
12. ASTM E96 - Water Vapor Transmission of Materials.
13. ASTM F1869 - Test Method for Measuring Moisture Vapor Emission.
14. ASTM F2170 - Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes.

F. DSA IR 19-3 Interpretation of Regulations, Fly Ash and Natural Pozzolans Used in Concrete.

G. CSS - Caltrans Standard Specifications, Latest Edition.

1.03 SUBMITTALS

A. Placement Schedule: Submit for approval details and/or sketches showing location of each proposed construction joint. Do not deviate from locations of horizontal joints indicated on drawings.

B. Product data for each type of manufactured material and product included.

C. Design mix for each concrete mix.

D. Steel reinforcement shop drawings, including material, grade bar schedules, spacing, bent bar diagrams, arrangement and supports.

E. Submit contraction (crack control) joint, expansion, isolation and construction joint layout to Architect for approval.

F. Project Record Documents:
1. Accurately record actual locations of embedded utilities and components that are concealed from view.
2. Maintain an accurate record showing date and time of concrete placement in each portion of structure. Correlate placing record for test cylinders made by testing laboratory. Maintain a separate record giving date of removal of forms, shoring, including first and second halves and reshoring, if used. Keep records available for inspection at site. Upon completion, deliver two copies of each to Architect in approved form.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with Section 1905A.1.16, California Building Code, and ACI 318 Section 26.12.

B. Maintain one copy of all records.

C. Acquire cement and aggregate from same source for all work.

D. Conform to ACI 318 Section 26.5.5, when concreting during hot weather. No concrete placement permitted above 90 degrees Fahrenheit.

E. Conform to ACI 318 Section 26.5.4 when concreting during cold weather. No concrete placement permitted below 50 degrees Fahrenheit.

F. Mock-ups: Before casting concrete, build mock-ups concrete slab-on-grade and formed-surface panels to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mock-ups to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mock-ups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Demonstrate curing, cleaning, and protecting of cast-in-place architectural concrete, finishes, and contraction joints, as applicable.
   3. In presence of Architect, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
   4. Obtain Architect’s approval of mockups before casting architectural concrete.
   5. Approved mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 COORDINATION

A. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I or II. Portland Cement Type, conforming to Section 1903A, California Building Code.

B. Aggregates:
   1. Aggregate for Stone Concrete: ASTM C33.

C. Conform to requirements specified herein for maximum size of aggregate permitted in individual applications.

D. Water, ASTM C1602: Clear, from potable source, and not detrimental to concrete.

E. Fly Ash:
   1. Fly ash: may be used at 25% replacement of the Portland cement, at a 1:1 replacement ratio by weight. The fly ash shall meet the requirements of ASTM C 618 with the exception that the Loss on Ignition (LOI is a measure of the loss in mass of a fly ash sample when placed in a 750 degrees C oven) shall not exceed 1.0%. Only Class F material is permitted, CBC Section 1903A.5.
   2. When fly ash is used the quantity of water shall be determined on a water-cement plus fly ash basis.
   3. Comply with requirements of DSA IR 19-3 fly ash in excess of 15% by weight, per 2019 CBC, Section 1903A.5. including requirement for mix design to bear Civil Engineer's signature and seal.

2.02 ACCESSORIES

A. Concrete Formwork: In accordance with Section 03 10 00.

B. Reinforcement: In accordance with Section 03 20 00.

C. Bonding Agent: ASTM C631, Polyvinyl Acetate Latex emulsion; HIBOND, manufactured by Lambert Corporation, Orlando FL, LOCK BOND NO. 906, manufactured by Macklanburg-Duncan Co., City of Industry, CA, or equal.

D. Curing Film: ASTM C171; 10 mil thick, clear polyethylene film, single sheet, manufactured from virgin resin with no scrap or additives, free of visible defects, uniform in appearance, conforming to the following:
   1. Moisture Loss: 0.055 g per sq. cm.
   2. Tensile Strength: 1700 psi longitudinal, 1200 psi transverse.
   3. Elongation: 225 percent longitudinal, 350 percent transverse.

E. Non-Shrink Grout: ASTM C1107, Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 5,000 psi in 24 hours and 8,000 psi in 7 days; of consistency suitable for application and a 30-minute working time.

F. Underslab Vapor Retarder: Refer to Section 07 26 00, Vapor Retarder.

G. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8" and that can be feathered at edges to match adjacent floor elevations. Products by Tile-Tex by Flintkote Co., Webtex #60 or Fixallatex by Dowman Products Co or equal.

H. Combination Hardener, and Sealer: Refer to Section 03 35 00, Concrete Finishing.

I. Interior/Exterior Compound: ARDEX TILT WALL PATCH or equal as approved in accordance with Division 01 for substitutions., cementitious surface treatment for filling and smoothing interior and exterior vertical concrete surfaces prior to sealing or painting.

J. Secondary Reinforcement (shrinkage control): Synthetic-fiber-reinforced concrete contains virgin homopolymer polypropylene. Fibrillated polypropylene fibers engineered and designed for use in concrete, complying with ASTM C1116, Type III, 1/2 to 1-1/2 [1-1/2 to 2] inches long by the Forta Corporation, GCP Applied Technologies or equal. Dosage: 1.5 lbs per cubic yard of concrete [0.2%, 3.0 lbs/cu.yd] [0.33%, 5.0% lbs/cu.yd.]

2.03 JOINT DEVICES AND FILLER MATERIALS

A. Fiber Expansion Joint Filler - ASTM D1751: Closed cell, 1/2 inch max. thick; FIBER EXPANSION JOINT by American Highway Technology, Kankakee, IL, FIBRE EXPANSION JOINT or DECK-O-FOAM by W. R. Meadows, Dayton Superior or approved equal.

B. Expansion Joint Top: Integral extruded polystyrene plastic; 1/2 inch thick, with removable top strip exposing sealant trough, JOINT CAPS manufactured by The Burke Company, or equal.

C. Primer: As recommended by sealant manufacturer.

D. Joint Backing: ASTM C1330, Cylindrical, Type C, closed cell, polyethylene backer rod; oversized 30 to 50 percent larger than joint width. Green Rod by Nomaco Inc. or equal.

E. Sealant: Polyurethane two-component type, self-leveling, for level surface application, UREXPAN NR-200 or DYNATRED for sloped surfaces, manufactured by Pecora Corp., Harleysville PA, or equal. Color shall be selected by Architect.

F. Saw-Cut Joint Filler: Two-component epoxy resin, gray color, non-hardening, self-leveling, SIKADUR 51 (SL), by Sikacorp., Lyndhurst, NJ, or equal.

2.04 CONCRETE MIX

A. Mix and deliver concrete in accordance with ACI 318 Sections 26.4 and 26.5. Deliver concrete in transit mixers only. Discharge loads in less than 1-1/2 hours after water is first added.
   1. Design Mix: Conform to Section ACI 318 Chapter 26 for Proportioning on the basis if field experience or trial mixtures method.
   2. Conform to ACI 318, Section 26.4 for Selection of concrete proportions method. Selection of concrete proportions and ingredients for design mix by a DSA approved Testing Laboratory and certified by a registered civil engineer licensed in California.
   3. Do not exceed 0.45 water-cement ratio by weight for floor slabs and for other concrete.

B. Select proportions by volume for concrete in accordance with the approved design mix.
   1. Required Strength: As noted on the structural drawings and below.
   2. Grout Mix: 1:3:2 Portland Cement, to sand, to pea gravel, minimum 2000 psi at 28 days.

C. Provide concrete to the following criteria: As shown on the plans

D. Miscellaneous Sitework Concrete: Specified in Division 32.

E. Do not use admixtures containing chlorides.

2.05 GRANULAR FILL

A. Crushed Aggregate Base (capillary break): 3/4 inch maximum grading, crushed rock and rock dust conforming to requirements of Section 200-2.2, SSPWC, with 3/8 inch sieve requirement waived.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify compaction has been completed per Division 31, Earthwork.

C. Verify requirements for concrete cover over reinforcement.

D. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely and will not cause hardship in placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with sandblasting to remove laitance and expose clean aggregate.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. When approved by the Architect, clean previously placed concrete with steel brush and apply bonding agent in accordance with manufacturer's instructions.

D. Under Interior Slabs on Grade: Install 4 inches thick crushed aggregate base per Section 200-2.2, SSPWC or Class 2 CCS as capillary break. Over aggregate base place 15-mil vapor retarder in largest practical sections. Seal all 6-inch lapped seams, penetrations and foundation perimeters using manufacturer-approved tape only and

install per manufacturer instructions. Install pipe boots at pipe penetrations. Install reinforcement and concrete as scheduled.

1. Installation of vapor retarder shall be in accordance with Section 07 26 00.
2. Tapes, mastics, sealants, and other products used with vapor retarder shall be from same manufacturer as, and certified compatible with, vapor retarder.

E. Install steel reinforcing per Section 03 20 00. Place concrete slab as scheduled.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 318, Section 26.5.2. Remove loose dirt from excavations.

B. Notify Architect minimum 24 hours prior to commencement of operations. All excavations, forms and reinforcing shall be inspected and approved by the Architect prior to placement.

C. Ensure reinforcement, inserts, embedded parts, formed joint fillers, joint devices and accessories are not disturbed during concrete placement.

D. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

E. When detailed on the drawings, separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.

F. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface using two-component polyurethane sealant.

G. Install joint devices in accordance with manufacturer's instructions as detailed.

H. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

I. Maintain joint device in correct position to allow joint cover flush with finish.

J. Install joint covers in longest practical length.

K. Place concrete continuously between predetermined expansion, control and construction joints.

1. Install expansion joints at vertical concrete walls at 24 feet on center unless noted otherwise on drawings.
2. Retaining Walls at Buildings: install waterstops in expansion joints to form a continuous waterproofed wall surface condition. Support and protect exposed waterstops during progress of the Work.

L. Do not interrupt successive placement; do not permit cold joints to occur.

M. Avoid segregation of materials. Perform vibrating so as to produce a dense, smooth application free of rock pockets and voids. Do not use vibrators to move concrete horizontally.

N. Provide special mix prepared by the Testing Laboratory and approved by the Architect utilizing smaller aggregates in areas of reinforcing congestion to prevent the formation of rock pockets.

O. The unconfined vertical drop of concrete shall not be greater than 5 feet. Do not allow concrete to fall free from any height that will cause materials to segregate. Maximum height of free fall permitted in any case: 5 feet. Utilize trunks or additional chutes where doubt occurs. Conform to requirements of ACI 318, Section 26.5.2.

P. Construction Joints: Wash surface of each joint shortly after pouring to expose clean, sound aggregate. Sandblast surface to remove laitance remaining or loose aggregate as approved by the Architect. Conform to ACI 318, Section 26.5.6. Apply bonding agent in accordance with manufacturer's instructions. Locate joints within the middle third of spans of slabs, beams and girders. Coincide construction joints with contraction, isolation, or expansion joints when possible. Locate where they lease affect the structural integrity of the element under consideration and are compatible with building’s appearance.

Q. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/8 inch in 10 ft. Slope floors for drains.

R. Contraction Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch, place joints at column lines and at 12 ft. o.c. each way, maximum. Remove groover tool marks on exposed concrete surfaces. Contractor’s option: Saw cut joints, early-entry dry-cut, per ACI 302.1R.

S. Saw cut slabs when indicated on drawings or as approved by Architect at 12 ft. on center, within 4-12 hours after placing concrete. Saw cut joints with power saws equipped with shatterproof abrasive re diamond-rimmed blades, cut 1/8 " wide joint into concrete when cutting action will not tear, abrade, or otherwise damage surface. Cut no deeper than 1/4 depth of slab thickness. Fill cuts with non-hardening epoxy. Completely fill cut to surface of slab. Sawing and timing: "early-entry dry-cut ", per ACI 302.1R. Section 8.3.12.

T. Isolation Joints: preformed joint filler depth of slab, fill top 1/2 inch with elastomeric sealant per manufacturer's recommendations. Locations: at columns, footings, and as noted on drawings.

U. Steel Pan Stairs: Install safety nosings at each tread, all steel pan stairs.

V. Surface irregularities, ACI 347R Class A, gradual or abrupt irregularities of 1/8 inch for exposed to view concrete. Class B, 1/4 inch for plaster cement finish.

3.04 CONCRETE FINISHING

A. Refer to Section 03 35 00, Concrete Finishing

3.05 FINISH AT ALL EXPOSED SURFACES

A. Refer to Section 03 20 00, Concrete Formwork.

3.06 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury.

B. Maintain concrete with minimal moisture loss at above 50 degrees F temperature for period necessary for hydration of cement and hardening of concrete. Dusting with dry cement to absorb excess water is prohibited.

C. Cure floor surfaces only as specified herein and in accordance with Section 1905A.11, California Building Code. Liquid membrane curing compound method not permitted for interior cast-in-place concrete slabs.

D. Moisture Retaining Coverings: spread polyethylene film over floor slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for minimum of seven (7) day unless noted otherwise on the drawings. Do not permit traffic over floor slabs during the curing period.

E. Vertical Surfaces: Spray water over surfaces and maintain wet for 10 days.

F. Quality Control: Proper curing of concrete surfaces shall be the responsibility of the Contractor under this section.

3.07 FIELD QUALITY CONTROL

A. Provide free access to Work and cooperate with Testing Laboratory.

B. Measure floor and slab flatness and levelness according to ASTM E1155 within 72 hours of finishing.

C. Proposed mix design of each class of concrete shall conform to ACI 318, Section 26.4, California Building Code and shall be approved by the Architect prior to commencement of work.

3.08 PATCHING

A. Architect will inspect concrete surfaces and determine imperfections, if any.

B. Patch imperfections as approved and in accordance with ACI 301.
   1. Clean all exposed concrete surfaces and all adjoining work stained by leakage of concrete. Remove all fins, butts and projections by grinding. Patch voids, rock pockets, holes, cracks and similar imperfections by chipping loose concrete and exposing clean, sound aggregate.
   2. Fill cone form tie recesses with portland cement mortar flush to finish surface.

3.09 PROTECTION FOR EXPOSED CONCRETE TO BE TREATED OR SEALED

A. Protection. There is no known satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Protect the concrete floor until ready for treatment/sealing.
   1. All hydraulic powered equipment must be diapered to avoid staining of the concrete.
   2. No trade shall park vehicles on interior slabs. If necessary to complete their scope of work, drop cloths shall be placed under vehicles at all times.
   3. No pipe cutting machine shall be used on interior slabs.
   4. Steel shall not be placed on interior slabs to avoid rust staining.
   5. All equipment must be equipped with non-marking tires.

B. Flooring shall be protected as follows: Use "Ram Board Plus ", Burbank, CA. "Builder Board with Liquid Shield " by Surface Shields, Oakland Park, ILL, or equal.
   1. Ram Board: Heavy Duty temporary floor protection membrane, 38 " wide x 100' rolls, 46 mils thick.
   2. Protect entire floor where area anticipated to be affected. Submit layout of protected area to Architect for approval.
   3. Loose lay protection material over floor area; tape all seams; do not tape or otherwise attach to floor; follow manufacture's installation requirements.
   4. Take other precautions as necessary to prevent damage in addition to requirements above, refer to Section 03 35 00. Submit to Architect for approval.

3.10 DEFECTIVE CONCRETE

A. Defective Concrete: Remove concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect.

C. Do not patch, fill, touch-up, repair or replace exposed concrete except upon express approval of Architect for each individual area.

END OF SECTION

SECTION 04 05 17

MORTAR AND GROUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Mortar and grout for masonry.

B. Related Sections:
1. Section 04 22 00, Reinforced Unit Masonry System.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ACI - American Concrete Institute / ASCE - American Society of Civil Engineers
1. TMS402/ACI 530/ASCE 5 - Building Code Requirements for Masonry Structures
2. TMS602/530.1/ASCE 6 - Specification for Masonry Structures.

C. ASTM - American Society for Testing and Materials
1. ASTM A36 - Carbon Structural Steel
2. ASTM A307- Carbon Steel Bolts and Studs
3. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement
4. ASTM C90 - Concrete Masonry Units
5. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
6. ASTM C150 - Portland Cement
7. ASTM C207 - Hydrated Lime for Masonry Purposes
8. ASTM C216 - Facing Brick (Solid Masonry Units Made from Clay or Shale)
9. ASTM C270 - Mortar for Unit Masonry
10. ASTM C331 - Light Weight Aggregates for Concrete Masonry Units
11. ASTM C404 - Aggregate for Masonry Grout
12. ASTM C476 - Grout for Masonry
13. ASTM C494 - Chemical Admixtures for Concrete
14. ASTM C1019 - Test Method of Sampling and Testing Grout
15. ASTM C1314 - Test Method for Compressive Strength of Masonry Prisms
16. ASTM C1384 - Standard Specification for Admixtures for Masonry Mortars.
17. ASTM C1586 - Guide for Quality Assurance of Mortars
18. ASTM C1714 - Standard Specification for Pre-Blended Dry Mortar Mix for Unit Masonry

D. AWS - American Welding Society
1. AWS D1.4 - Structural Welding Code, Reinforcing Steel

E. CBC - 2019 California Building Code
1. CBC-21 - CBC Chapter 21A, Masonry

F. DSA - Division of State Architect, Interpretation of Regulations (IR)
   1. DSA IR 21-1, Masonry Wall Non-Structural
   2. DSA IR 21-2, CMU - High Lift Grouting

1.03 SUBMITTALS

A. Product data including design mix, method used, required environmental conditions and admixture limitations.
   1. For each type of mortar and grout, include description of type and proportions of ingredients.
      a. Include test reports for mortar mixes required to comply with property specification. Testing according to ASTM C109, ASTM C1506, and ASTM C150.
      b. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

B. Samples include two ribbons of mortar color, illustrating color and color range.

C. Manufacturer's certificate that products meet or exceed specified requirements.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store and protect products.

B. Maintain packaged materials clean, dry and protected against dampness, freezing and foreign matter.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperatures to minimum 40 degrees F prior to, during and 48 hours after completion of masonry work.

1.06 MIX TESTS

A. Test mortar and grout in accordance with Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150, Type I or II.

B. Mortar Aggregate: Wash sand with clean potable water and per Section 2103A.8 2019 CBC, ASTM C 144.

C. Hydrated Lime: ASTM C207, Type S.

D. Grout Aggregate: Section 2103A.12.3 2019 CBC, ASTM C404.

E. Water: Clean and potable.

F. Bonding Agent:
   1. WELD-CRETE; Larsen Products Corp., Rockville, MD.
   2. THOROBOND; Thoro System Products, Newark, CA.
   3. SONOCRETE; Sonneborn Building Products, Hayward, CA.
   4. Or equal, as approved in accordance with Division 01, General Requirements for substitutions.

G. Admixture: ASTM C494, early-water-loss reducing admixture, at high-lift grouting only, Sika GroutAid for Brick and CMU shall be used. Other products require pre-approval from approving agency.

2.02 MORTAR COLORS

A. Mortar Color: Pure mineral oxide pigment; colors as selected by the Architect.
   1. TRUE TONE; Davis Colors, Los Angeles, CA, or equal as approved in accordance with Division 01, General Requirements for substitutions.

B. Color Intensity: Up to 4 lbs. per sack of masonry cement.

2.03 MORTAR MIXES - PROPORTIONS BY VOLUME

A. Mortar Type and Proportions: ASTM C 270, Table 1 for Cement-Lime Mortar Type S, 1 part Portland cement, 1/4 to 1/2 part lime and loose damp sand in the amount of not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials.

B. Mortar strength: 1800 psi minimum at 28 days and mix to conform to Section 2103A, and ASTM C 270.

2.04 MORTAR MIXING

A. Thoroughly mix mortar ingredients in quantities needed for immediate use. No admixtures permitted. Add lime last, in accordance with Section 2103A and Table 2103A.8(2) 2019 CBC.

B. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration. Omit mortar color where surfaces are scheduled to receive plaster or paint.

C. Do not use anti-freeze compounds to lower the freezing point of mortar.

D. If water is lost by evaporation, retemper by fully mixing with required volume of water, only within one hour of mixing. Dashing or pouring water over mixture not permitted.

E. Use mortar within two hours after mixing at temperatures of 80 degrees F or two-and-one-half hours at temperatures under 50 degrees F.

2.05 GROUT MIXES - PROPORTIONS BY VOLUME

A. Per TMS 602/ACI 530.1/ASCE 6, Article 2.2.

B. Fine Grout: 1 part Portland cement, 0 to 1/10 part hydrated lime, loose damp sand in the amount of 2-1/4 to 3 times the sum of the volumes of the cementitious materials. Sufficient water shall be added to grout to cause it to flow into all joints of the masonry.

C. Coarse Grout: 1 part Portland cement, 0 to 1/10 part hydrated lime, loose damp sand (fine aggregate) in the amount of 2-1/4 to 3 times the sum of the volumes of the cementitious materials, coarse aggregate (pea gravel) in the amount of 1 to 2 times the sum of the volumes of the cementitious materials.

D. Grout Strength: 1200 psi minimum at 7 days, 2000 psi minimum at 28 days, and conform to Section 2103A, California Building Code 2019.

E. Use Fine Grout for cavity behind cement masonry and brick veneer. Coarse grout for all filled-cell masonry.

F. Use Fine Grout at grouted metal door frames.

2.06 GROUT MIXING

A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.

B. Do not use anti-freeze compounds to lower the freezing point of grout.

2.07 CALIBRATING

A. Proportion mortar and grout mixes by accurate volume measurements in accordance with Section 2103A, California Building Code. Maintain at the site, calibrated boxes or containers of such nature that quantities measured can be readily and accurately checked at any time. Proportion by shovel measure not permitted.

2.08 STRENGTH

A. Mortar: Minimum compressive strength at 28 days, 1800 psi.

B. Grout: Minimum compressive strength 2000 psi.

PART 3 - EXECUTION

3.01 TESTING AND INSPECTION

A. Request inspection of spaces to be grouted. Masonry work shall be continuously inspected during laying and grouting by the Special Masonry Inspector certified by DSA, in accordance with Section 1704A.5, 2019 California Building Code.

B. Testing: as specified in Division 01, General Requirements, for quality assurance.
   1. CMU Sampling and Testing: ASTM C140
   2. Mortar Sampling and Testing: ASTM C1586
   3. Prism Testing: ASTM C1314
   4. Grout Sampling and Testing: ASTM C1019

5. Masonry Core Testing: CBC 2105A.4

3.02 PREPARATION

A. Apply bonding agent to existing surfaces.

B. Plug cleanout holes to prevent leakage of grout materials. Brace masonry for wet grout pressure.

3.03 INSTALLATION

A. Install mortar and grout in accordance with Section 2104A, California Building Code.

B. Work grout into masonry cores and cavities to eliminate voids. Use coarse grout in cavities 2 inches wide or more and in all filled cell construction.

C. Do not displace reinforcement while placing grout.

D. Remove grout spaces of excess mortar.

E. Fill door frame voids solid with mortar. Coat inside frames with corrosion resistant coating if anti-freezing agents are used in mortar.

3.04 CURING

A. When atmosphere is extremely dry, dampen the masonry surfaces with a light fog spray for three days during the curing period for the mortar. Use a nozzle regulated fog spray sufficiently to dampen but not of such quantities to cause water to flow down over masonry.

END OF SECTION

SECTION 04 22 00

REINFORCED UNIT MASONRY SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Concrete masonry units.

B. Reinforcement, anchorage and accessories.

C. Related Sections:
1. Section 04 05 17, Mortar and Grout.
2. Section 07 19 00, Water Repellents.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ACI - American Concrete Institute / ASCE – American Society of Civil Engineers
1. TMS 402/ACI 530/ASCE 5 - Building Code Requirements for Masonry Structures
2. TMS 602/ACI 530.1/ASCE 6 - Building Code Requirements and Specification for Masonry Structures.

C. ASTM - American Society for Testing and Materials
1. ASTM A36 - Carbon Structural Steel
2. ASTM A307 - Carbon Steel Bolts and Studs
3. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement
4. ASTM C90 - Concrete Masonry Units
5. ASTM C 144 - Aggregate for Masonry Mortar
6. ASTM C150 - Portland Cement
7. ASTM C207 - Hydrated Lime for Masonry Purposes
8. ASTM C270 - Mortar for Unit Masonry
9. ASTM C331 - Light Weight Aggregates for Concrete Masonry Units
10. ASTM C404 - Aggregate for Masonry Grout
11. ASTM C476 - Grout for Masonry
12. ASTM C494 - Chemical Admixtures for Concrete
13. ASTM C1019 - Test Method of Sampling and Testing Grout
14. ASTM C1314 - Test Method for Compressive Strength of Masonry Prisms
15. ASTM C1384 - Standard Specification for Admixtures for Masonry Mortars.
16. ASTM C1714 - Standard Specification for Pre-Blended Dry Mortar Mix for Unit Masonry.

D. AWS - American Welding Society
1. AWS D1.4 - Structural Welding Code, Reinforcing Steel

E. CBC - 2019 California Building Code

1. CBC-21 - CBC Chapter 21A, Masonry (for DSA)

F. DSA - Division of State Architect, Interpretation of Regulations (IR)
1. DSA IR 21-1, Masonry Wall Non-Structural
2. DSA IR 21-2.10, CMU - High Lift Grouting

1.03 SUBMITTALS

A. Material Certificates: For each type and size of the following:
1. Masonry Units:
a. Include product data and material test reports.
b. Cementitious Materials. Include manufacturer, brand and type.
c. Mortar Admixtures.
d. Mortar Mixes: Product Data
e. Grout Mixes: Type and Proportions of ingredients.
f. Reinforcing Bars.
g. Joint Reinforcement.
h. Anchors, Ties, and Metal Accessories.

B. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

C. Three samples of concrete masonry units to illustrate color, texture and extremes of color range.

1.04 QUALITY ASSURANCE

A. Installer’s Qualifications. Company specializing in performing the work of this Section with minimum five years of experience.

B. Tests and Inspections: Division 01, General Requirements.

C. Mock-up
1. Provide mock-up of concrete masonry in a location as approved.
2. Erect masonry to 3 by 4 feet panel size. Include specified mortar and accessories and one expansion joint.
3. When accepted, mock-up will demonstrate minimum standard for the work. Mock-up may remain as part of the work.

D. Pre-installation Conference
1. Convene minimum two weeks prior to commencing Work of this Section.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site, store and protect materials from damage.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do no masonry work when surrounding air temperature is anticipated to be 40 degrees F or lower, within 48-hours of placement.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Acceptable Manufacturers. Products of following manufacturers form basis for design and quality intended.
   1. Angelus Block Co., Inc., Sun Valley, CA.
   2. Trenwyth Industries, Inc.
   3. Orco Block Co., Inc. Stanton, CA
   4. RCP Block and Brick, Lemon Grove, CA
   5. Basalite, Tracy, CA
   6. Or equal, approved in accordance with Division 01 requirements for substitutions.

B. Hollow Load Bearing Block Units: ASTM C90, normal weight. Minimum compressive strength: 2150 psi per Table 2105A.2.2.1.2.

C. Masonry Units: Nominal modular size of 8 by 8 by 16 inches. Provide special units for 90 degree corners and special profiles as indicated, provide caps same color as walls.
   1. Color: tan
   2. Texture: Smooth

D. Provide units manufactured in one batch production to ensure continuity of color.

E. Shapes: Provide shapes indicated and as follows:
   1. Provide special shapes for lintels, corners, jambs, sashes, caps, movement joints, headers, bonding, and other special conditions.
   2. Provide Square-edged units for outside corners, unless otherwise indicated.

2.02 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615, deformed billet steel bars, in grades as follows, and conforming to CBC-19, Section 1903A.
   1. For No.4 and larger bars, use 60 ksi yield grade.
   2. For ties and stirrups, and No. 3 and smaller bars, use 40 ksi yield grade.
   3. For welded bars, use ASTM A706 60 ksi yield grade.

2.03 ACCESSORIES

A. Steel Wire Ties: Minimum 16 gauge black annealed type.

B. Expansion Joint Filler: premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, "Closed Cell Neoprene" by Sandell Manufacturing, or equal.

C. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

D. Sealant: Two component Polyurethane, Non-sag, as specified in Section 07 92 00.

E. Backer Rod: Closed cell polyethylene; oversized 50 percent to joint width; self-expanding; ASTM C1330 Class O, DENVER FOAM (open cell) or ASTM C1330 Class C, GREEN ROD (closed cell), manufactured by the Pecora Corp., Harleysville, PA, or equal as approved in accordance with Division 01, General Requirements for substitutions.

F. Cleaning Solution: Not harmful to masonry work or adjacent materials.
   1. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   2. Manufacturer: Sure Klean Custom Masonry Cleaner by ProSoCo, Inc. or equal

G. Primers: manufacture’s standard product for flashing specified.

H. Preformed Control-Joint Gaskets: styrene-butadiene-rubber type, ASTM D2287.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify items provided by other Sections of work are properly sized and located.

C. Beginning of installation means installer accepts existing conditions.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied by other Sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place.

C. Sandblast concrete foundation clean prior to installation of first masonry course. Clean construction joints accordance with Section 1906A.4 CBC.

D. Install flashings as detailed.

3.03 COURSING

A. Establish lines, levels and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal 8 inches. Form concave mortar joints.

3.04 PLACING AND BONDING

A. Lay hollow masonry units in full bed of mortar with full head joints, uniformly jointed with other work.

B. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.

C. Remove excess mortar as work progresses.

D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. In texture-faced block assemblies, provide smooth-face block where required for attachment or mounting of building elements such as signage, and mechanical and electrical fittings and fixtures.

3.05 REINFORCEMENT

A. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.06 GROUTED COMPONENTS

A. Lap splices in reinforcing steel minimum 72 bar diameters. Welded splices required for No. 8 bars or larger.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position. Wire positioners or other approved devices are required.

C. Place and consolidate grout fill without displacing reinforcing.

3.07 ENGINEERED MASONRY

A. Reinforced hollow unit masonry shall be built to preserve the unobstructed vertical continuity of the cells. Head joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells. Conform to Section 2104A, California Building Code.

B. Walls and cross webs forming such cells shall be full-bedded in mortar to prevent leakage of grout.

C. Mortar shall be as specified in Section 04 05 17.

D. Bond shall be provided by lapping units in successive vertical courses. Where stack bond is used in reinforced hollow unit masonry the open end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inch on center.

E. Vertical cells shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell measuring not less than 2 inches x 3 inches.

F. At the time of laying, masonry units shall be free of excessive dust and dirt.

G. Grout shall be workable mix suitable for placing without segregation and shall be thoroughly mixed. Grout shall be placed by pumping or an approved alternate method and shall be placed before initial set or hardening occurs. Grout shall be consolidated by puddling or mechanical vibration during placing and reconsolidating after excess moisture has been absorbed but before workability is lost. The grouting of any section of a wall shall be completed in one day with no interruptions greater than one hour. All cells shall be filled.
   1. Grout per Section 04 05 17.

H. Reinforcing except tie wires shall be embedded in the grout. The spacing between masonry units and reinforcing shall be a minimum of one bar diameter.

I. Horizontal reinforcement shall be placed in bond beam units. The openings through webs for horizontal reinforcement shall be a minimum of 3 inch x 3 inch.

J. Reinforcing shall be in place prior to grouting. Vertical reinforcing bars shall be held in position at the top, bottom and at intervals not farther apart than 160 bar diameters.

3.08 LOW LIFT GROUTED CONSTRUCTION

A. Units shall be laid a maximum of 4 feet before grouting all cells. All overhanging mortar and mortar droppings shall be removed. Conform to Section 2104A.5.1.1.2, California Building Code.

B. Grouting shall follow each 4 feet high lift of construction laid and shall be consolidated so as to completely fill all voids and embed all reinforcing steel. When grouting is stopped for one hour or longer, horizontal construction joints shall be formed by stopping the pour of grout not less than 1/2 inch nor more than 2 inch below the top of uppermost unit grouted.

C. Seal cleanouts before grouting with mortar, finish to match surface of CMU, color and texture.

D. All cells shall be grouted.

E. Horizontal steel shall be fully embedded in grout in an uninterrupted pour.

3.09 HIGH LIFT GROUTED CONSTRUCTION

A. Where high lift grouting is used, conform to Section 2104A.5.1.1.3, California Building Code and DSA Interpretation Regulation IR 21 - 2. Unless specifically approved otherwise, the maximum height of pour will be 12 feet for walls with a nominal thickness of less than 12 inches, and 16 feet for walls with a nominal thickness of 12 inches or more

B. Cleanout openings shall be provided at the bottom of each pour of grout. Any overhanging mortar or other debris shall be removed from the insides of cell walls.

C. The foundation or other horizontal construction joints shall be cleaned of all loose material and mortar droppings before each pour.

D. Seal cleanouts before grouting with mortar, finish to match surface of CMU, color and texture.

E. All cells shall be grouted.

F. Approved admixture that reduces early water loss and produces an expansive action shall be used in the grout as specified in Section 04 05 17.

3.10 EXPANSION AND CONTROL JOINTS

A. Install control joints at approximately 20 feet on center maximum 25 feet on centers and seismic expansion joints at maximum 50 feet on center, unless indicated otherwise on drawings.

B. Install preformed control joint devices in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size of expansion joints in accordance with Section 07 92 00 but not less than 3/8 inch, and as required for optimum sealant performance.

D. Form expansion joint to full depth of wall, sealant both sides.

3.11 BUILT-IN WORK

A. As work progresses, build in metal frames, anchor bolts and other items furnished by other Sections.

B. Build in items plumb and level.

C. Bed anchors of metal frames in adjacent mortar joints. Fill frame voids solid with mortar.

D. Do not build in organic materials subject to deterioration.

3.12 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.

B. Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.

C. Maximum Variation From Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet 1/2 inch in 30 feet.

D. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.13 CUTTING AND FITTING

A. Cut and fit for conduit, sleeves, piping, grounds and other inserts. Coordinate with other Sections of work to provide correct size, shape and location. Cut blocks neatly and true.

B. Obtain Architect's and DSA approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

C. At openings of chases in textured-face walls, grind faces of block to smooth finish all-around opening as required for face-plate or frame of cover assembly. Grinding shall leave uniform gap all-around installed cover of approximately 1/2-inch.

3.14 CURING

A. When atmosphere is dry, dampen the masonry surfaces with a light fog spray for three days during the curing period for the mortar. Use a nozzle regulated fog spray sufficiently to dampen but not of such quantities to cause water to flow down over masonry.

3.15 WATER REPELLENT COATING

A. Apply in accordance with Section 07 19 00.

3.16 FIELD QUALITY CONTROL

A. Continuous inspections by Inspector of Record in accordance with Section 1704A.5.

B. Test and inspect in accordance with requirements of Division 01, General Requirements, and CBC Section 2105A.4.

3.17 CLEANING

A. Remove excess mortar and mortar smears. Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with an approved cleaning solution. After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
   3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clean water.
   5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.18 PROTECTION OF FINISHED WORK

A. Protect finish installation from damage.

B. Without damaging completed work, provide protective boards at exposed external corners that may be damaged by construction activities.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.
   1. Galvanized, prime and paint, at exterior exposed structural steel.
   2. Shop-primed at concealed and at painted steel.

B. Related Sections:
   1. Section 09 90 00, Painting.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. AISC - American Institute of Steel Construction:
   1. AISC Manual - AISC Manual of Steel Construction (AISC 325), 16th Edition.
   2. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.
   3. AISC 360 - Specification for Structural Steel Buildings.
   4. AISC 341 - Seismic Provisions for Structural Steel Buildings including Supplement No. 1.

C. ASTM International:
   1. ASTM A36 - Structural Steel
   2. ASTM A53 - Steel Pipe, Black and Hot-Dip Zinc-Coated, Welded and Seamless
   3. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality
   4. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
   5. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware
   6. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners
   7. ASTM A325 - High Strength Bolts for Structural Steel Joints
   8. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
   9. ASTM A500 - Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
   10. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
   11. ASTM A572 - Grade 50 - Structural Steel
   12. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
   13. ASTM A992 - Steel for Structural Shapes for Use in Building Framing
   14. ASTM C1107 - Packaged Dry, Hydraulic Cement Grout (Non-Shrink)
   15. ASTM F1554 - Standard Specification for Anchor Bolts.

16. ASTM F1554 - Standard Specifications for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

D. ASCE/SEI 7 - American Society of Civil Engineers, Structural Engineers Institute, ASCE Standard.

E. AWS - American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing and Non-Destructive Examination.
2. AWS A5.1 - Carbon Steel Electrodes for Shielded Metal Arc-Welding.
3. AWS A5.5 - Low Alloy Steel Electrodes for Shielded Metal Arc-Welding.
4. AWS B2.1 - Welding Procedure and Performance Qualification.
5. AWS D1.1 - Structural Welding Code, Steel.
6. AWS D1.2 - Structural Welding Code, Aluminum.
7. AWS D1.3 - Structural Welding Code, Sheet Steel.
8. AWS D1.6 - Structural Welding Code, Stainless Steel.
9. AWS D1.8 - Structural Welding Code, Seismic Supplement.

F. SSPC - Steel Structures Painting Council.

G. CBC - California Building Code 2019, Chapter 22A.

1.03 SUBMITTALS

A. Shop Drawings:
1. Indicate profiles, sizes, spacing and locations of structural members, connections, openings, attachments and fasteners.
2. Indicate cambers.
3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

B. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

C. Mill Test Reports: showing structural strength, destructive and non-destructive test analysis and identification.

D. All certified welders employed on the work have been AWS qualified within the previous 12 months, in accordance with AWS-WHB-1.

E. Fabricator's and erector's qualifications and certifications.

F. Submit written welding procedures to Owner's testing agency for all welding on project. Procedures shall be in accordance with AWS pre-qualified welds. For welds not pre-qualified by AWS, provide project-specific procedures qualified by testing in accordance with AWS D1.1 to match actual materials, conditions, and orientations.

G. Paint Compatibility Certificates: From manufacturer of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Fabricator: Company specializing in performing structural steel work minimum five years' experience. Qualified fabricator who participates in the AISC Quality Certification Program and its designation as AISC-Certified Plant, Category Sbd Conventional steel building structures or Category Cbd for complex steel building structures.
   2. Erector: Company specializing in performing structural steel work with minimum five years' experience.
   3. Erector: AISC Certified Erectors for Category CSE-Certified Steel Erector for steel and erection required.
   4. City of Los Angeles Department of Building and Safety certification (license) for the steel Fabricator and Erector is acceptable in lieu of certification by AISC.
   5. AWS Certified welders.
   6. DSA-Projects: All welding shall be specially inspected by an AWS-CWI Qualified Inspector.

B. Fabricate structural steel members and perform work in accordance with AISC-M015L.

C. Perform welding in accordance with AWS D1.1 and California Building Code Section 2204A.1.

D. Galvanized Structural Steel Coating applicator: Company specializing in hot-dip galvanizing after fabrication and following the procedures in the *Quality Assurance Manual* of the American Galvanizers Association.

1.05 FIELD MEASUREMENTS

A. Verify field measurements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel Members: W-Shape Sections use ASTM A992 as indicated on Structural Drawings.

B. Channels, Angles, Plates, Bars, M-Shapes and S-Shapes: ASTM A36.

C. Structural Tubing: Hollow Structural Sections (HSS), ASTM A500, Grade B, minimum yield strength, 42 ksi.

D. Pipe: ASTM A53, Type E or S, Grade B, Schedule 40.

E. Shear Stud Connectors: ASTM A108, Grade 1015 forged steel, headed, uncoated, granular flux filled shear connector or anchor studs by Nelson Stud Welding Division of

TRW, Lorain, OH, or equal as approved in accordance with Division 01 for substitutions.

F. Bolts, Nuts and Washers: ASTM A307 galvanized to ASTM A153 for galvanized members, American National Course Threaded Series.

G. Anchor Bolts, Pins and Rods: ASTM F1554.

H. High Strength Bolts: ASTM A325 Slip-Critical, tension set high strength bolts, by Bristol Machine Co., Walnut, CA, or equal as approved in accordance with Division 01 for substitutions.

I. Welding Materials: AWS A5.1, E70XX, type and procedures required by electrode manufacturer for materials being welded.

J. Non-Shrink Grout: ASTM C1107, high performance, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 5,000 psi in 24 hours and 8,000 psi in 28 days; of consistency suitable for application and a 30 minute working time.

K. In-Shop Primer: Series L69 Hi Build Epoxoline II, Red color Low VOC epoxy, air dried, by Tnemec or equal. [Manufacturer's standard primer for unpainted steel permanently enclosed in walls and above finished ceilings.]

L. Touch-Up Material for Galvanized Steel: ASTM D520 Type III High Purity Grade zinc dust, ready mixed, zinc-rich galvanizing compound 95% metallic zinc. Galvilite by ZRC Wordwide, Marshfield, MA or equal.

2.02 SHEAR STUD CONNECTORS

A. Space shear stud connectors as indicated on the drawings.

B. Completely fuse end of stud to plate. Allow no porosity in weld.

C. Allowable decrease in length of stud during welding:
   1. 1/8-inch for 5/8-inch diameter and smaller.
   2. 3/16-inch for more than 5/8-inch diameter.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP-3 Power Tool Cleaning for embedded steel. Apply primer by brush or spray, minimum dry film thickness 3.0 mils.

B. Shop prime structural steel members. DO NOT prime surfaces that will be fireproofed, field welded, in contact with concrete or high strength bolted.
   1. Clean surfaces to be primed, remove mill scale, grease, dirt and foreign matter. Two coats required for parts in contact but inaccessible for painting after erection.

2. Apply primer by brush or spray, minimum dry film thickness 3.0 mils. Thoroughly work into joints, angles and open spaces. Allow primer to dry and harden prior to handling for delivery to the site.
3. Clean contact surfaces immediately prior to assembly, leave unpainted.
4. Coat machined surfaces with approved removable coating to prevent corrosion.
5. After erection, clean field welds, field bolts and abraded portions and apply one additional brush spot coat using same paint material.
6. All surfaces scheduled to receive sprayed-applied fireproofing shall be free of lubricants, oils, paint or other matter that will impair adhesion of fireproofing.

C. Galvanize exposed exterior structural steel members where indicated to minimum Coating Grade 80 (1.9 oz/sq. ft.) in accordance with ASTM A123.

D. Galvanized items to be painted: Do not use quenching solutions or treatments immediately after galvanizing. Refer to individual sections for galvanized items to be painted, and to Section 09 90 00, Painting.

D. All exterior steel exposed to weather conditions shall be shop galvanized and primed painted. Field painted in accordance with Section 09 90 00 Painting, High Performance Coatings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.
1. Report discrepancies between drawings and field dimensions to Architect before commencing work.

B. Beginning of installation means erector accepts existing conditions and surfaces underlying or adjacent to work of this section.

3.02 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

B. Camber structural steel members where indicated.

C. Identify high-strength structural steel according to ASTM A6 and maintain markings until steel has been erected.

D. Mark and match-mark materials for field assembly.

E. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.

F. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.

G. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

3.03 ERECTION

A. Allow for erection loads and stresses, and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection and installation of permanent bracing. Provide bracing for dead and live loads and wind loads. Keep bracing in place until required to maintain safe conditions.

B. Contractor shall be responsible for correcting detailing and fabrication errors and for correct fitting of all members and components.

C. Field weld components and shear studs indicated on structural drawings.

D. Do not field cut or alter structural members without approval of Architect.

E. When approved, perform cutting, punching, drilling and tapping to accommodate work. Obtain accurate data as indicated on shop and erection drawings.

F. After erection, prime welds, abrasions and surfaces not shop primed except surfaces to be in contact with concrete.

G. Grout under base plates with the specified non-shrink grout.

H. Provide anchor bolts with templates and diagrams. Contractor shall be responsible for proper location and installation of bolts. Correct deficiencies or errors.

3.04 ERECTION TOLERANCES

A. Conform to AISC 303 Code of Standard Practice for Steel Buildings and Bridges.

3.05 HIGH STRENGTH BOLTS

A. Allowable hole sizes: 1/16 inch larger than bolt size.

B. Use friction type connection with standard hardened steel circular, square or rectangular washer under bolt nut.

C. Thoroughly clean area under bolt head, nut and washer. Remove all paint, lacquer, oil or other coatings except organic zinc-rich paints in accordance with SSPC, SP-2.

D. Tighten bolts by power torque wrench or hand wrench until twist-off.

3.06 PUNCHING AND DRILLING

A. Punch material 1/16 inch larger than nominal diameter of bolt, wherever thickness of metal is equal to or less than the diameter of the bolt plus 1/8 inch.

B. Drill or sub-punch and ream where metal is equal to or more than the diameter of the bolt plus 1/8 inch. Make diameter for sub-punched and sub-drilled holes 1/16 inch larger than nominal diameter of bolt.

C. Precisely locate holes to ensure passage of bolt through assembled materials without drifting. Enlarge holes when necessary to receive bolts by reaming, flame cutting to enlarge holes is not acceptable. Poorly matched holes will be rejected.

D. Punch and ream holes to receive high strength bolts.

3.07 WELDING

A. Conform to AWS D1.1 and CBC Chapter 22A, Section 2204A.1.

B. Perform welding by direct electric arc process. Use operators certified within preceding 12-month period as per AWS "Standard Qualification Procedure."

C. Chip welds to remove slag. Use wire brush to demonstrate uniformity of section, smoothness of welded metal, freedom from undercuts, overlays or feather edges and freedom from porosity and clinkers.

D. Visually inspect edges and ends of fillets and butt joint welds for indication of good fusion and penetration into base metal. Grind smooth all exposed welds.

E. Use of cutting torch will be allowed where metal being cut does not carry stress during the operations and provided no stresses will be transmitted through a flame-cut surface. Make gas cuts smooth and regular in contour.

F. To determine effective width of members subjected to gas cutting, deduct 1/8 inch from width of gas cut edges. Make radius of gas cut fillets as large as practicable, but in no case less than one inch. Gas cutting to align bolt is not permitted.

3.08 CLEANING AND STRAIGHTENING

A. Before fabrication, thoroughly wire-brush material clean of scale and rust. Straighten by methods that will not injure materials.

B. After punching or working, remove twists or bends before parts are assembled. Make finished members free from twists, bends and open joints when erected.

C. Touch-Up Material for Galvanized Steel: Ready mixed, zinc-rich galvanizing compound, ASTM A780 - A2. Repair Using Paints Containing Zinc Dust, minimum thickness 5 mils.

3.09 FITTING

A. Closely fit members, finished true to line and in precise position required to allow accurate erection and proper joining in the field.

B. Drilling to enlarge unfair holes will not be allowed. Light drifting to draw parts together will be permitted. Do not heat rolled sections, except for minor details.

3.10 QUALITY CONTROL

A. Required testing shall be performed under provisions of Division 01, General Requirements and California Building Code Section 2205A.

B. All complete penetration welds shall be subject to Ultrasonic Testing, as per AWS D1.1. All defective welds shall be repaired and retested with ultrasonic equipment at the Contractor's expense.

3.11 HANDLING

A. Both in shop and in field, transport, handle and erect to preclude damage or overstressing of any component.

3.12 FINISH

A. For exposed steel, field paint per Section 09 90 00 Painting with High Performance Coatings.

END OF SECTION

SECTION 05 12 13

ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes requirements regarding the appearance and surface preparation of Architecturally Exposed Structural Steel (AESS).

B. This Section applies to any members noted on Architectural and Structural Drawings as (AESS) and in the areas defined as AESS below.

C. Related Sections:
   1. Section 09 90 00, Painting.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Conference: The General Contractor shall schedule and conduct conference at the project site to comply with requirements of Division 01, General Requirements. As a minimum the meeting shall include the General Contractor, Fabricator, Erector, the finish-painting subcontractor, and the Architect. Coordinate requirements for shipping, special handling, attachment of safety cables and temporary erection bracing, touch up painting and other requirements for AESS.

1.03 SUBMITTALS

A. Product Data: for each type of product specified.

B. Shop Drawings: detailing fabrication of AESS components.
   1. Provide erection drawings clearly indicating which members are considered as AESS members.
   2. Include details that clearly identify all of the requirements listed in Article 2.03 Fabrication and Article 3.03 Erection of this specification. Provide connections for exposed AESS consistent with concepts shown on the Architectural or Structural Drawings.
   3. Indicate welds by standard AWS Symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined herein.
   4. Indicate type, size, finish and length of bolts distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections; [Orient Bold heads on same surface exposed to view] [Orient bold heads on same surface on opposite side of exposed to view].
   5. Clearly indicate which surfaces or edges are exposed and what class of surface preparation is being used.
   6. Indicate special tolerances and erection requirements as noted on the drawings or defined herein.

C. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of Architects and Owners, and other information specified.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Section 05 12 00, Structural Steel, engage a firm experienced in fabricating AESS similar to that indicated for this Project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the Work.

B. Erector Qualifications: In addition to those qualifications listed in Section 05 12 00, Structural Steel, engage an experienced Erector who has completed AESS work similar in material, design and extent to that indicted for this Project and with a record of successful in-service performance.

C. Comply with applicable provisions of the following specifications and documents:
   1. AISC Code of Standard Practice, latest edition Section 10
   2. Structural steel framing indicated on drawings as "AESS" shall be designated as:
      a. AESS-1: Basic elements.
      b. AESS-2: Feature elements viewed at a distance greater than 20ft.
      c. AESS-3: Feature elements viewed at a distance less than 20ft.
      d. AESS-4: Showcase elements with special surface and edge treatment beyond fabrication.

D. Mock-ups: At least four weeks prior to fabricating AESS, the Contractor shall construct mockups to demonstrate aesthetic effects as well as qualities of materials and execution. A mockup for each of the following elements shall be constructed: Build mockups to comply with the following requirements, using materials indicated for final unit of Work:
   1. Locate mockups on-site or in the fabricator's shop as directed by Architect. Mockups shall be full-size pieces unless the Architect approves smaller models.
   2. Notify the Architect one week in advance of the dates and times when mockups will be available for review.
   3. Demonstrate the proposed range of aesthetic effects regarding each element listed under the fabrication heading below.
   4. Mockup will have finished surface (including surface preparation and paint system).
   5. Obtain Architect's approval of mockups before starting fabrication of final units.
   6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
      a. Approved mockups in an undisturbed condition at the time of Substantial completion may become part of the completed work.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver AESS to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

C. Erect pre-painted finish pieces using padded slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning member's frames. Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Architect during the pre-installation meeting. Methods of removing temporary erection devices and finishing the AESS members shall be approved by the Architect prior to erection.

1.06 PROJECT CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.07 COORDINATION

A. Coordinate installation of anchors for AESS members that connect to the work of other trades. Furnish setting drawings, templates, and directions for installing anchors, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the project site in time for installation. [Anchorage concepts shall be as indicated on drawings and approved on final shop drawings.]

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Meet requirements in Section 05 12 00 Structural Steel. As amended below.

B. High Strength Bolts, Nuts and Washers: Per Section 05 12 00 heavy hex heads and nuts. Provide standard carbon steel finish.

2.02 PRIMERS

A. Compatibility: The General Contractor shall submit all components/procedures of the paint system for AESS as a single coordinated submittal. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable) and finish coat. All of the items shall be coordinated with the finish coat specified in Division 09.

B. Primer: Per High Performance Coatings as specified in Section 09 90 00.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for galvanizing welds and repair-painting galvanized steel, with dry-film coating not less than 90 percent zinc dust by weight.

2.03 FABRICATION

A. Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Fabricate AESS with exposed surfaces smooth, square and of surface quality consistent with the approved mock-up. Use special care in handling and shipping of AESS both before and after shop painting.

C. Architecturally Exposed Structural Steel: Reference AISC 303 Section 10:
   1. AESS-1:
      a. The permissible tolerances for member depth, width, out of square, and camber and sweep shall be as specified in ASTM A6/A6M-204, ASTM A500/A500M, and ASTM A1085/A1085M.
      b. Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the Architect. Detail AESS assemblies to minimize field handling and expedite erection.
      c. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures
      d. Remove all backing and run out tabs.
      e. Grind all sharp edges smooth, including all sheared, punched or flame cut edges.
      f. Provide a continuous appearance to all welded joints including tack welds. Provide joint filler at intermittent welds.
      g. Provide bolt type and finish as noted herein.
      h. Welded Connections: Comply with AWS D1.1 and as noted herein. Appearance and quality of welds shall be consistent. Assemble and weld built-up Sections by methods that will maintain alignment of members without warp exceeding the tolerance of this Section.
      i. Install all bolts on the same side of the connection. Oriented uniformly in the direction indicated Consistent from one connection to another.
      j. Remove all weld spatter, slivers, and similar surface discontinuities.
      k. Grind off projections larger than 1/16" at butt and plug welds.
      l. Continuous Weld Appearance: Where continuous welding is noted on the drawings, provide welds of a uniform size and profile.
      m. Seal Welds: Seal weld open ends of round and rectangular hollow structural Section with 1/8" closure plates. Provide venting as required for galvanized members.
   2. AESS-2:
      a. Fabricate to requirements of 3.02.C.1 and as follows:
      b. The as-fabricated straightness tolerance shall be one half that specified in ASTM A6/A66M, ASTM A500/A500M, or ASTM A1085/A1085M.
      c. For curved structural members, whether composed of a single standard structural shape or built-up, the as-fabricated variation from the theoretical curvature shall be equal to or less than the standard camber and sweep tolerances permitted for straight members in the applicable ASTM standard.
      d. The tolerance on overall profile dimensions of welded built-up members shall be one-half of that specified in AWS D1.1/D1.1M.

e. Provide hidden part marks or piece marks that may be fully removed after erection.

3. AESS-3:
   a. Fabricate to requirements of 3.02.C.2 and as follows:
   b. Fabricate AESS with exposed surfaces smooth, square and of surface quality consistent with the approved mock-up.
   c. Grind projections at butt and plug welds to be smooth with the adjacent surface.
   d. Orientation of HSS scams shall be as indicated on Drawings.
   e. Copes, miters, and cuts in surfaces exposed to view shall have a maximum gap of 1/8" in an open joint. If the gap is shown to be in contact, the contact shall be uniform within 1/16".
   f. Mill marks shall not be exposed to view. If it is not possible to hide mill marks, then the mill marks are to be removed by appropriate length cutting of mill material. If this is not possible, the fabricator shall remove the mill mark, grind, and fill the surface to be consistent with the approved mock-up.
   g. The matching of abutting cross Sections is required.
4. AESS-4:
   a. Fabricate to requirements of 3.02.C.3 and as follows.
   b. Contouring and blending of welds: Where welds are indicated to be ground contoured, or blended, oversize welds as required and grind to provide a smooth transition and match profile on approved mock-up.
   c. Minimize Weld Show Through: at locations where welding on the opposite side of an exposed connection creates distortion, weld show through shall be minimized to conform to the approved mock-up.
   d. Open holes shall be filled with weld metal or body filler and smoothed by grinding or filling to the standards applicable to the shop fabrication of the materials.

2.04 SHOP CONNECTIONS

A. Bolted Connections: Make in accordance with Section 05 12 00. Provide bolt type and finish as noted herein and align bolt heads as indicated on the approved shop erection drawings.

B. Weld Connections: Comply with AWS D1.1 and Section 05 12 00. Appearance and quality of welds shall be consistent with the mock-up. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding tolerance of this section.

2.05 SHOP PRIMING

A. Shop-prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2".
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections, if primer does not meet the specified AISC slip coefficient.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC Specifications as follows:
   1. SSPC-SP 6 "Commercial Blast Cleaning".
   2. Coordinate the required blast profile with the approved paint submittal prior to beginning surface preparation.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

2.06 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to AESS indicated for galvanizing according to ASTM A 123. Fabricate such that all connections of assemblies are made in the field with bolted connections. Provide galvanized finish or members and assemblies within the range of color and surface textures presented in the mock-ups.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The erector shall check all AESS members upon delivery for twist, kinks, gouges or other imperfections which might result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

3.02 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on the approved shop drawings. Temporary connections not shown shall be made at locations not exposed to view in the final structure or as approved by the Architect. Handle, lift and align pieces using padded slings and/or other protection required to maintain the appearance of the AESS through the process or erection.

3.03 ERECTION

A. Set AESS accurately in locations and to elevations indicated, and according to AISC specifications referenced in this Section.

B. Architecturally Exposed Structural Steel: use special care in unloading, handling and erecting the steel to avoid marking or distorting the steel members. Minimize damage to any shop paint. When temporary braces or erection clips are used. Avoid unsightly surfaces upon removal. Tack welds: Ground smooth and holes filled with weld metal or body solder and smoothed by grinding or filing. Plan and execute all operations in such a manner that the close fit and neat appearance of the structure will not be impaired. Refer to ANSI/AISC 303, Section 10.

1. Erection AESS-1:
    a. Place weld tabs for temporary bracing and safety cabling at points concealed from view in the completed structure or where approved by the Architect during the pre-installation meeting. Methods of removing temporary erection devices and finished the AESS members shall be approved by the Architect prior to erection.
    b. AESS erection tolerances: Erection tolerances shall meet the requirements of standard frame tolerances for structural steel per Chapter 7 of ANSI/AISC 303.
    c. Set AESS accurately in locations and to elevations indicated and according to AISC specifications referenced herein.
    d. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
    e. Remove all backing and run out tabs.
    f. When temporary braces or fixtures are required to facilitate erection, care shall be taken to avoid any blemishes, holes or unsightly surfaces resulting from the use or removal of such temporary elements.
    g. Bolted Connections: align bolt heads on the same side of the connection as indicated on the approved fabrication or erection documents.
    h. Weld Connections: Comply with AWS D1.1 and as specified herein. Appearance and quality of welds shall be consistent. Employ methods that will maintain alignment of members without warp exceeding the tolerance of this Section.
    i. Remove all weld spatter exposed to view.
    j. Grind off projections larger than 1/16" at field butt and plug welds.
    k. Continuous Welds: Where continuous welding is noted on the drawings, provide continuous welds of a uniform size and profile.
    l. Do not enlarge holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replacement connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.
    m. Splice members only where indicated.
    n. Obtain permission for any torch cutting or field fabrication from the Architect. Finish Sections thermally cut during erection to a surface appearance consistent with the mock-up.
2. Erection AESS-2
    a. Erect to the requirements of 3.03.B.1 and as follows.
    b. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of ANSI/AISC 303.
3. Erection AESS-3
    a. Erect to the requirements of 3.03.B.2 and as follows.

b. Field Welding: Weld profile, quality, and finish shall be consistent with mock-ups approved prior to fabrication.
c. Provide a continuous appearance to all welded joints including tack welds. Provide joint filler at intermittent welds.

4. Erection AESS-4
a. Erect to the requirements of 3.03.B.3 and as follows.
b. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection creates distortion, grind distortion and marking of the steel to a smooth profile with adjacent material.
c. Filling of weld access holes: Where holes must be cut in the web at the intersection with flanges on W shapes and structural tees to permit field welding of the flanges, they shall be filled with joint filler.
d. Where welds are indicated to be ground, contoured, or blended, oversize welds as required and grind to provide a smooth transition and match profile on approved mock-up.

C. Field welding: Weld profile, quality, and finish shall be consistent with mock-ups approved prior to fabrication.

D. Splice members only where indicated.

E. Obtain permission for any torch cutting or field fabrication from the Architect. Finish sections thermally cut during erection to a surface appearance consistent with the mock-up.

F. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable finial appearance.

3.04 FIELD CONNECTIONS

A. Bolted Connections: Install bolts of the specified type and finish in accordance with Section 05 12 00, Structural Steel.

B. Welded Connections: Comply with AWS D1.1 for procedures, and appearance. Refer to Section 05 12 00, Structural Steel for other requirements.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp. Verify that weld sizes, fabrications sequence, and equipment used for AESS will limit distortions to allowable tolerances.
2. Obtain Architects approval for appearance of welds in repaired or field modified work.

3.05 FIELD QUALITY CONTROL

A. Structural requirements: The Owner will engage an independent testing and inspecting agency to perform field inspections and test and to prepare test reports. Refer to Section 05 12 00 Structural Steel for detailed bolt and weld testing requirements.

B. AESS acceptance: The Architect shall observe the AESS steel in place and determine acceptability based on the mockup. The testing Agency shall have no responsibility for enforcing the requirements of this Section.

3.06 FINISH

A. Paint per Section 09 90 00, Painting with High Performance Coatings.

3.07 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint shall be completed to blend with the adjacent surfaces of AESS. Such touch up work shall be done in accordance with manufacturer's instructions as specified in Section 09 90 00, Painting.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

SECTION 05 52 00

HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Steel pipe railings, handrails, balusters and posts.
   2. Brackets and fittings.

B. Related Sections:
   1. Section 09 90 00, Painting.
   2. Division 32 Section(s) for concrete used in post footings.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ADA - Americans with Disabilities Act of 1990 as amended
   1. Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design

C. ASTM International
   1. A 36/A 36M - Carbon Structural Steel
   2. A 47/A 47M - Ferritic Malleable Iron Castings
   3. A 48/A 48M - Gray Iron Castings
   4. A 53/A 53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
   5. A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   6. A 743/A 743M - Castings, Iron-Chromium, Iron-Chromium-Nickel
   7. A 780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
   8. C 1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

D. AWS - American Welding Society
   1. D1.1 - Structural Welding Code - Steel

E. CBC - 2019 California Building Code, 24 CCR Part 2
   1. Chapter 10 - Means of Egress
   2. Chapter 11B - Accessibility to Public Buildings

F. MIL - Military Specifications, United States Department of Defense
   1. P-21035 - Paint, High Zinc Dust Content, Galvanizing Repair

G. MPI - Master Painters Institute Approved Products List
   1. 18 - Primer, Zinc Rich, Organic.
   2. 19 - Primer, Zinc Rich, Inorganic

H. NOMMA - National Ornamental & Miscellaneous Metals Association
   1. Guideline 1 - Joint Finishes

I. SSPC - The Society for Protective Coatings
   1. Paint 20 - Zinc-Rich Coating (Type 1 Inorganic and Type II Organic)

J. AWS - American Welding Society
   1. AWS A2.4 - Standard Symbols for Welding, Brazing and Non Destructive Examination
   2. AWS A5.1 - Carbon Steel Electrodes for Shielded Metal Arc-Welding
   3. AWS A5.5 - Low Alloy Steel Electrodes for Shielded Metal Arc-Welding
   4. AWS B2.1 - Welding Procedure and Performance Qualification
   5. AWS D1.1 - Structural Welding Code, Steel
   6. AWS D1.3 - Structural Welding Code, Sheet Steel
   7. AWS D1.8 - Structural Welding Code, Seismic Supplement

1.03 DESIGN REQUIREMENTS

A. Handrails
   1. The mounting of handrails shall be such that the completed handrail and support structure shall be capable of withstanding vertical and lateral single concentrate load of 200 pounds applied in any direction at any point on the rail, or 50 pounds per linear foot per applied in any direction at the top, Section 1607A.8 of CBC.

1.04 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners and accessories.

B. Samples: Submit three samples of handrail and each component.

C. Submit structural calculations signed and sealed by Structural Engineer licensed in California for railings where walking surface or floor levels exceeding 48 inches from adjacent ground or level.

D. Welder's Certificates: Welders shall be Project certified in accordance with AWS D1. 1-02.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, Structural Welding Code-Steel. Certified Welders required.

B. Mock-ups
   1. Provide 4' x 4' mock-up, including frames, in-fill panels, supports, and anchorage.
   2. Mock-up shall include finishes specified.
   3. Do not proceed with fabrication without approval by Architect.
   4. Mock-up shall not be incorporated into the Work and shall be removed from site upon completion of the Work.

1.06 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Top of gripping surfaces of handrails shall be 34" minimum and 38" maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above such surfaces.

B. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1-1/2" minimum. Handrail may be located in a recess if the recess is 3" maximum deep and 18" minimum clear above the top of the handrail.

C. Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20% of their length. Where provided, horizontal projections shall occur 1-1/2" minimum below the bottom of the handrail gripping surfaces.

D. Handrail gripping surfaces with a circular cross section shall have an outside diameter of 1-1/4" minimum and 2" maximum.

E. Handrail gripping surfaces with a non-circular cross section shall have an outside dimension of 4" minimum and 6-1/4" maximum, and a cross-sectional dimension of 2-1/4" maximum.

F. Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges.

G. Handrails shall not rotate within their fittings.

H. Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs in accordance with CBC Section 11B-505.10. Such extensions are not required for continuous handrails at the inside turn of switchback or dogleg stairs and ramps.

I. The orientation of at least one handrail shall be in the direction of the stair run, perpendicular to the direction of the stair nosing, and shall not reduce the minimum required width of the stair. CBC Section 11B-505.2.1.

J. At 2" minimum high curb or barrier shall be provided to prevent the passage of a 4" diameter sphere rolling off the edges on a ramp or landing surface. Such a curb or barrier shall be continuous and uninterrupted along the length of a ramp. CBC Section 11B-405.9.2.

2.02 MATERIALS

A. Manufacturers:
1. Craneveyor Corp., South El Monte, CA.
2. R & B Wagner Inc./McNichols Co. South Gate, CA.
3. Julius Blum & Co. Inc.
4. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

B. Railings, Handrails, Guardrails, Balusters, and Posts: Steel pipe, ASTM A 53/A 53M, Grade A, Type F or Type S, Grade A, black, 1-1/4 inch NPS, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads (for posts spaced more than 48 inches on centers, use Schedule 80 Extra Heavy), 1.660 inch outside diameter, welded joints. Refer to details for other sizes of posts, guardrails and spacing of balusters.

C. Fittings: Elbows, T shapes, wall brackets, escutcheons, caps: Steel, finish to match rails.
1. Wall Rail Brackets: Weld mounted, 1/4" thick material, formed or cast, round top to accept tube rail, size to allow 1-1/2 inch clearance from rail to wall.

D. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing. Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

E. Sleeve: Pipe ASTM A53, Grade B, Type E or S, Schedule 40, galvanized. Contractor's option: "EZ Sleeve" Model EZ 4012 by R & W Wagner, 12" H, 7/16" thick plastic tapered tube.

F. Nonshrink Grout:
1. Cement Based Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 24 hours and 8,000 psi in 7 days; of consistency for application and a 30 minute working time. 1107 Advantage Grout by Dayton Superior, Miamisburg, OH; Sonogrout 10K by BASF; Super Por-Rok Anchoring Cement by Novex Systems International, Clifton, NJ; or equal.

G. Touch-Up for Galvanized Surfaces to be Painted: SSPC - Paint 20, Mil-P-21035, or MPI #18 or #19, Ready mixed zinc-rich cold galvanizing compound, 95% zinc rich, ASTM D520, Type III, Galvilite by ZRC Products Company, Marshfield, MA. or equal as approved in accordance with Division 01, General Requirements for Substitutions.

H. Touch-Up for Exposed Galvanized Surfaces: Solder Zinc Alloy; ASTM A780 Annex A1, Welco Gal-Viz self-fluxing solder alloy, Galvabar by Peterson Fluxes or equal.

I. Galvanizing Repair Material: DRYGALV as manufactured by the American Solder and Flux Company, Galvalloy, Galvion, or equal. Hot applied repair material, or anodic zinc- rich galvanizing repair paint conforming to Mil Spec DOD-P-21035.

2.03 FABRICATION

A. Fabricate handrails of specified pipe or tubing only in conformance with requirements of CBC 13 and 11B, Section 11B-505.
   1. Handrails: Weld bracket to bottom of handrail.
   2. Handrail clearance: weld handrail to bracket to allow clearance of 1-1/2" between the wall and the handrail, Section 11B-505.5.
   3. The handgrip portion of handrails for stairs and ramps shall not be less than 1-1/4" nor more than 1-1/2" in cross-sectional nominal dimension or a shape providing an equivalent gripping surface, CBC Section 11B-505.6.

B. Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
   1. Assemble handrails and railings in shop to greatest extent possible to minimize field splicing and assembly.
   2. Corners: Standard flush weld pipe ells, welded and ground smooth.
   3. All surfaces and welded joints of the grip portion of handrails shall be ground smooth with no sharp corners. Gripping surfaces (top or sides) shall be uninterrupted by newel posts, other construction elements or obstructions. Edges shall have a minimum radius of 1/8".
   4. Any wall or other surface adjacent to handrail shall be free of sharp or abrasive elements.
   5. Wheel guide rails or guide curbs shall provide continuous and uninterrupted barrier along the length of a ramp.

C. Fabricate components with joints tightly fitted and secured.

D. Welded Joints. Seal joined members by continuous welds. Dress welded joints, ground smooth, leaving no burrs, or sharp or abrasive corners, edges or surfaces CBC 11B-505.8.
   1. Where exposed to view, dress welds in accordance with NOMMA Guidelines for Finish 1.
   2. Where concealed, dress welds in accordance with NOMMA Guidelines for Finish 3.

E. Exposed Mechanically Fastened Joints. Make exposed, mechanically fastened joints hairline-tight, flush, butt joints. Secure with flush-mount, countersunk, screws or bolts; unobtrusively located; consistent with design of component, except where specifically indicated otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

G. Accurately form components to each other and to building structure.

H. Finish
   1. Hot-Dip Galvanized in accordance with ASTM A 123 for steel and iron products; ASTM A 153 for steel and iron hardware.

a. Coating Grades shall be as follows:
   1) Exterior railings scheduled for galvanized with a field painted finish: G60.
b. Galvanize after fabrication in largest practical sections; omit galvanizing at areas to be field welded.
c. Surfaces shall be free of icicles, spangles and puddling. Provide venting holes at all enclosed sections, "V" notch and drilled holes are acceptable. Locate to prevent rainwater from entering section at exterior galvanized items. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
d. Galvanized items to be field painted: Do not use quenching solutions or treatments immediately after galvanizing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive Work.

B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION

A. Clean and strip steel items to bare metal where site welding is required.

3.03 INSTALLATION

A. Provide concrete footings 6" diameter, 12" deep under each post. Set vertical supports in galvanized steel sleeves with specified non-shrink grout. Option for EZ Sleeve, set before or immediately after concrete is poured. Install in precise location where railings will occur. Fill with non-shrink grout. Slope grout to drain at each post.

B. Install components plumb and level, accurately fitted, free from distortion or defects.

C. Provide anchors, plates or angles required for connecting railings to structure. Anchor railing to structure. Mount railings 1-1/2 inches clearance from side walls or columns. Top of handrail grasping surface shall be mounted between 34" to 38" above the nosing of the treads or the ramp surface.
   1. Field welds shall be dressed and ground smooth, to match shop welds, leaving no sharp or abrasive corner edges or surfaces.
   2. Gripping surfaces (top or sides) shall be uninterrupted by newel posts, other construction elements or obstructions. Edges shall have minimum radius of 1/8".
   3. Field weld anchors as indicated on shop drawings.
   4. Ends shall return smoothly to floor, wall, or post as indicated on Drawings.
   5. Any wall or other surface adjacent to handrail shall be free of sharp or abrasive elements, CBC Sections 11B-505.8.

D. Conceal bolts and screws. Where not concealed, use flush countersunk fastenings.

E. Wheel guide rails or guide curbs shall provide a continuous and uninterrupted barrier along the length of ramp, CBC Section 11B-405.9.2 and Figure 11B-405.8.2.

F. Repair surfaces scheduled for painted finish in conformance with ASTM A 780, Annex 2, touch up welds and chipped surfaces with specified galvanizing compound prior to painting, minimum thickness 5 mils.

G. Repair exposed galvanized surfaces in conformance with ASTM A 780, Annex 1. Apply Gal-Viz while metal is still hot. Tin surface with Gal-Viz with wire brush. Do not flame on alloy. Minimum thickness 5 mils.

3.04 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/16 inch in 3 feet.

3.05 FINISHES

A. Where painted finish is indicated, paint exterior railings with Gloss or Semi-Gloss Polyurethane High Performance Coatings in Special Coatings per Section 09 90 00 Painting.

3.06 SCHEDULE

A. As detailed and located in drawings.

END OF SECTION

SECTION 07 19 00

WATER REPELLENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water repellent coatings to:
   1. Exterior concrete masonry unit surfaces.

B. Related Section:
   1. Section 01 35 42, CALGreen Requirements.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. AQMD - Local Air Quality Management District Regulations.

1.03 SUBMITTALS

A. Product data including details of product description, tests performed, limitations to coating, cautionary procedures required during application and chemical properties, including percentage of solids.

B. Manufacturer's installation instructions.

C. Provide qualification data as required by Paragraph under Quality Assurance.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of water repellent coatings with 5 years minimum experience.

B. Applicator: 5 years experience in the application of the specified product and approved by the manufacturer.

C. Field Sample
   1. Apply coating to maximum 4 square feet vertical or horizontal area of surface.

D. Do not proceed with full application until sample has been subjected to water application and approved by Architect.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not apply coating when surface temperature is lower than 50 degrees F or higher than 100 degrees F.

B. Comply with AQMD Regulations.
   1. Water repellents less than 400 grams per liter.

1.06 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

B. Special Warranty: Submit written warranty, executed by applicator and water repellent manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch wide, fire, vandalism, or abuse by maintenance equipment.

C. Warranty Period: 5 years from Date of Certified Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Prosoco., Inc., Kansas City, KS. Product:
      a. Weather Seal Siloxane WB Concentrate.
   2. Raingard International Products Co, Corona Del Mar, CA; Product: Micro-Seal Concentrate.
   3. Okon, Inc., Denver, CO; Products: Plugger
   4. Harris Specialty Chemicals Inc./Hydrozo, Jacksonville, FL.
   5. Diedrich Technologies Inc., Oak Creek, WI.
   6. Sivento Inc., Somerset, NJ, Aqua-Trete Concentrate.
   7. Tnemec, Product: Chemprobe
   8. Evonik Industries, Product: Protectosil Chem-Trete PB 100.

B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

2.02 MATERIAL CHARACTERISTICS

A. Weather Seal Siloxane WB: Self-emulsifying water repellent concentrate for dilution with fresh water at jobsite. Solvent-free blend of silanes and oligomeric alkoxysiloxanes mixes easily with water, with following characteristics:
   1. Form: Liquid
   2. Color: Clear, amber
   3. Specific Gravity: 0.96
   4. Active Substance: Microemulsion concentrate of silanes and oligomeric alkyl alkoxysiloxanes
   5. Solids: 100% concentrate
   6. VOC: Maximum VOC content 120 grams/liter.

7. Flash Point 69^{0}F (in concentrate) (140^{0}F @ 1:9 dilution) (145^{0}F @1:14 dilution) ASTM D 3278

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify joint sealants are installed and cured.

B. Verify cracks and mortar-joint holes, bee holes are mortared.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of coating.

D. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Remove loose particles and foreign matter.

B. Remove oil or foreign substance with chemical solvent that will not affect coating.

C. Scrub and rinse surfaces with water and let dry completely.

D. Protect adjacent surfaces not scheduled to receive coating.

E. If applied on unscheduled surfaces, remove immediately by approved method.

F. Protect landscaping, property and vehicles.

3.03 APPLICATION

A. Delay work until masonry mortar substrate is cured minimum of 60 days, or as acceptable to coating manufacturer.

B. Concrete surfaces: Cured.

C. Apply coating in accordance with manufacturer's instructions by airless spray to provide continuous uniform coat.

D. Coatings:
1. Apply multiple coatings recommended by manufacturer for specific porosity of surface material, minimum two coats. Apply prepared solution within 8 hours of preparation.
   a. Weather Seal Siloxane WB: Dilution ratio 1 part concentrate: 9 parts water for vertical surfaces and 1 part concentrate: 5 parts water for horizontal surfaces.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Formed roof and wall sheet metal fabrications and accessories.

B. Related Sections:
   1. Section 09 90 00, Painting.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. California Building Code 2019, Chapters 14 and 15.

C. ASTM International:
   1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM B32 - Standard Specification for Solder Metal.
   4. ASTM D1187 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
   5. ASTM D4601 - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.

D. National Roofing Contractors Association (NRCA):
   1. NRCA Manual.

E. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):
   1. SMACNA Manual - Architectural Sheet Metal Manual.

1.03 SUBMITTALS

A. Product Data: for specified items.

B. Shop Drawings: showing material profile, jointing pattern, jointing details, fastening methods, connections to adjoining work, and installation details.

C. Manufacturer's installation instructions.

D. Samples: for each type of sheet metal flashing and trim indicated with field-applied color finishes.

E. Qualification Data: For Fabricator.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Fabricator with a minimum 3 years' experience fabricating sheet metal flashing and trim similar to Work required.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack preformed and pre-finished material to prevent twisting, bending, or abrasion and to provide ventilation.

B. Prevent contact with materials during storage that may cause discoloration, staining or damage.

1.06 FIELD CONDITIONS

A. Coordination:
   1. Coordinate sheet metal flashings and trims with adjoining roof and wall materials, joints, and seams to provide a weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim components and assemblies shall comply with SMACNA Standards for dimensions and profiles unless noted otherwise, and shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to fabrication, installation, or other defects in construction.

2.02 SHEET MATERIALS

A. Provide temporary protective film for finishes on exposed surfaces from damage prior to shipping.

B. Galvanized Steel: ASTM A653, G90 zinc-coated (galvanized) steel sheet.

2.03 ACCESSORIES

A. Fasteners: Type as required to withstand design loads.
   1. Fasteners for Galvanized Steel: Round head, galvanized steel, ASTM A153, or Series 300 stainless steel with soft neoprene washers at exposed fasteners. Finish exposed fasteners same as flashing metal.

B. Solder: ASTM B32; Grade Sn50, flux type and alloy composition as required for use with metals to be soldered. Raw muriatic acid for galvanized steel.

C. Galvanizing Repair: For repair of Galvanized sheet metal, Zinc type, Galvilite by ZRC or equal.

D. Bituminous Coating: Cold-applied asphalt emulsion, ASTM D1187.

2.04 FABRICATION

A. Form sections true to shape, accurate in size, square and free from distortion or defects. Fabricate all components per SMACNA standards unless more stringent conditions are imposed by the Roofing Contractor, in that case the more stringent conditions shall prevail.
   1. Verify shapes and dimensions of surfaces to be covered and obtain field measurements before shop fabrication.
   2. Fabricate and form sheet metal flashing and trim in shop to greatest extent possible.

B. Provide expansion joints for gutters at every 30 feet. Fabricate per SMACNA details.

2.05 FINISH

A. Galvanized Finish:
   1. ASTM A653, G90.

B. Shop prepare and prime exposed ferrous metal surfaces.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed and secure.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Field measure site conditions prior to fabricating Work.

B. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by Architect.

C. Lock and seal all joints.

D. Apply plastic-cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes and lines accurate to profiles.

F. Seal metal joints watertight.

3.03 INSTALLATION

A. Install sheet metal flashing and trim to comply with details indicated per SMACNA and NRCA standards that apply to installation required.
   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealants.
   2. Installation of sheet metal flashing and trim shall be weathertight, anchored securely in place, and capable of thermal and structural movement.

B. Apply bituminous paint on metal surfaces of units in contact with cementitious materials and dissimilar metals.

3.04 SCHEDULE

A. Gutters: Fabricate to detail of 20-gauge galvanized sheet metal. Install an expansion joint every 30 linear feet of gutter; install cover plates over expansion joints. Fabricate gutter without longitudinal seams. Install cradles of 1/4-inch x 1-1/2-inch galvanized steel at 36-inch centers. Gutters shall rest in cradles but shall not be mechanically fastened to allow for expansion and contraction. Slope to downspouts.

B. Downspouts and Strainers: Downspouts shall be 24-gauge, galvanized steel, rectangular unless noted otherwise. Strainers shall be 10-gauge galvanized steel wire basket type. Provide all anchor clips and straps as required for installation. Install a wire basket strainer in all downspouts at gutter level. Rivet and solder flange of downspout to gutters per SMACNA details. Locate downspouts every 30 feet unless otherwise noted on drawing. Provide splash pans.
   1. At steel pipe overflow-drain and interior drainpipe leaders install Downspout Nozzle #1770 by JR Smith, Montgomery, Alabama, or equal. Nickel bronze with bird screen cast bronze body and flange. Refer to Drawings for pipe sizes and locations of drains and leaders. Minimum pipe size Schedule 40, 4 inches, galvanized.
   2. Downspout Filter: FlowGard by KriStar Enterprises, Inc., Santa Rosa, CA or equal. Model FG-DS4, 4" diameter, box size 14 x 29 x 7.5 inches, dual-wall geotextile fabric liner encapsulating absorbent, surfaced mounted unit. Locate at each pipe drain.

3.05 FIELD PAINTING

A. Paint exposed metal flashings with High Performance paints in accordance with Section 09 90 00, for Special Coatings. Colors to be selected by Architect.

3.06 CLEANING

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

3.07 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed.

B. Maintain sheet metal flashing and trim in clean condition during construction. Replace damaged sheet metal flashing and trim as determined by Architect.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Door hardware, including electric hardware.
2. Storefront and entrance door hardware.
3. Card Access control system.
4. Door position switches.
5. Point-to-point wiring diagrams for electric hardware.
6. Gates

B. Related Divisions:

1. Division 06 – door hardware installation
2. Division 07 – sealant at exterior thresholds
3. Division 08 – metal doors and frames, interior aluminum frames, wood doors, integrated security systems, specialty doors, storefront and glazed curtainwall systems.
4. Division 10 – operable partitions
5. Division 21 – fire and life safety systems
6. Division 28 – security access systems

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.

1. Windows.
2. Cabinets, including open wall shelving and locks.
3. Signs.
4. Toilet accessories, including grab bars.
5. Installation.
6. Rough hardware.
7. Conduit, junction boxes & wiring.
8. Folding partitions.
9. Sliding aluminum doors.
10. Access doors and panels.
11. Corner Guards.
12. Welded steel gates and supports

1.2 REFERENCES**:**

A. Use date of standard in effect as of Bid date.

1. American National Standards Institute

a) ANSI 156.18 – Materials and Finishes.

2. BHMA – Builders Hardware Manufacturers Association
3. 2019 California Building Code

a) Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing

4. DHI – Door and Hardware Institute
5. NFPA – National Fire Protection Association
   a) NFPA 80 2016 Edition – Standard for Fire Doors and Other Opening Protectives.
   b) NFPA 105 – Smoke and Draft Control Door Assemblies
   c) NFPA 252 – Fire Tests of Door Assemblies
6. UL – Underwriters Laboratories
   a) UL10C – Positive Pressure Fire Tests of Door Assemblies.
   b) UL 305 – Panic Hardware
7. WHI – Warnock Hersey Incorporated State of California Building Code
8. Local applicable codes
9. SDI – Steel Door Institute
10. WI – Woodwork Institute
11. AWI – Architectural Woodwork Institute
12. NAAMM – National Association of Architectural Metal Manufacturers

B. Abbreviations
   1. Manufacturers**:** see table at 2.1.A of this section
   2. Finishes**:** see 2.7 of this section.

1.3 SUBMITTALS & SUBSTITUTIONS

A. SUBMITTALS**:** Submit six copies of schedule per D. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information**:**
   1. Type, style, function, size, quantity and finish of hardware items.
   2. Use BHMA Finish codes per ANSI A156.18.
   3. Name, part number and manufacturer of each item.
   4. Fastenings and other pertinent information.
   5. Location of hardware set coordinated with floor plans and door schedule.
   6. Explanation of abbreviations, symbols, and codes contained in schedule.
   7. Mounting locations for hardware.
   8. Door and frame sizes, materials and degrees of swing.
   9. List of manufacturers used and their nearest representative with address and phone number.
   10. Catalog cuts.
   11. Point-to-point wiring diagrams.
   12. Manufacturer’s technical data and installation instructions for electronic hardware.

B. Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.

C. Deviations**:** Highlight, encircle or otherwise identify deviations from “Schedule of Finish Hardware” on submittal with notations clearly designating those portions as deviating from this section.

D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.

E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.

F. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.

G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.4 QUALITY ASSURANCE**:**

A. Qualifications**:**

1. Hardware supplier**:** direct factory contract supplier who employs a hardware consultant, available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.

a) Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.

B. Hardware**:** Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.

C. Exit Doors**:** Operable from inside with single motion without the use of a key or special knowledge or effort.

D. Fire-Rated Openings**:** NFPA 80 compliant. Hardware UL10C (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.

E. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

F. Pre-Installation Meetings**:** Initiate and conduct with supplier, installer and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware and door closers in the meetings. Convene prior to commencement of related work.

1.5 DELIVERY, STORAGE AND HANDLING**:**

A. Delivery**:** coordinate delivery to appropriate locations (shop or field).

1. Permanent keys and cores**:** secured delivery direct to Owner's representative.

B. Acceptance at Site**:** Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

C. Storage**:** Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.6 PROJECT CONDITIONS AND COORDINATION**:**

A. Electrified hardware: Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. These electronic hardware components have been specified as an assembly. Changes to these components shall be submitted to the Architect for approval.

B. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.

C. Coordination**:** Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information**:**

1. Location of embedded and attached items to concrete.
2. Location of wall-mounted hardware, including wall stops.
3. Location of finish floor materials and floor-mounted hardware.
4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
5. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
6. Coordinate: low-voltage power supply locations.
7. Coordinate: back-up power for doors with automatic operators.
8. Coordinate: flush top rails of doors at out-swinging exteriors, and throughout where adhesive-mounted seals occur.
9. Manufacturers' templates to door and frame fabricators.

D. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.

E. Environmental considerations**:** segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.

1.7 WARRANTY**:**

A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.

B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:

C. Minimum warranties:

1.	Locksets:	Three years
2.	Exit Devices:	Three years mechanical One year electrical
3.	Closers:	Thirty years mechanical
4.	Hinges:	One year
5.	Other Hardware	Two years

1.8 COMMISSIONING:

A. Conduct these tests prior to request for certificate of substantial completion:

1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.
2. With installer, access control contractor and electrical contractor present, test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.
3. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

1.9 REGULATORY REQUIREMENTS:

A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2019 California Building Code, Section 11B-404.2.7.

1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.

B. Handles, pull, latches, locks, other operable parts:

1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2019 California Building Code Section 11B-309.4.
2. Force required to activate the operable parts: 5.0 pounds maximum, per 2019 California Building Code Section 11B-309.4.

C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2019 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

1. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

D. Low-energy powered doors: comply with ANSI/BHMA A156.19. Reference: 2019 California Building Code Section 11B-404.2.9.

1. Where powered door serves an occupancy of 100 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 100 cycles.

2. Actuators, vertical bar type: minimum 2-inches wide, 30-inches high, bottom located minimum 5-inches above floor or ground, top located minimum 35-inches above floor or ground. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7.

3. Actuators, plate type: use two at each side of the opening. Minimum 4-inches diameter or 4-inches square. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7. Locate centerline of lower plate between 7- and 8-inches above floor or ground, and upper plate between 30- and 44-inches above floor or ground.

4. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.

E. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2019 California Building Code Section 11B-404.2.8.

1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.

F. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2019 California Building Code Section 11B-404.2.10.

1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.

G. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2019 California Building Code Section 11B-404.2.3.

1. Exception: doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches. Example: shallow closets.
2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2019 California Building Code 11B-307.4.

H. Thresholds**:** floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2019 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches**:** beveled to slope no greater than 1**:**2 (50 percent slope). 2019 California Building Code Section 11B-303.2 & ~.3.

I. Floor stops**:** Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).

J. Pairs of doors with independently-activated hardware both leafs**:** limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2019 California Building Code Section 11B-703.4.2.

K. Door and door hardware encroachment**:** when door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, with the exception of door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2019 California Building Code, Section 1005.7.1.

1. In I-2 occupancies, surface mounted latch release hardware, mounted to the side of the door facing away from the adjacent wall where the door I sin the open position, is not exempt from the inclusion in the 7-inch maximum encroachment, regardless of its mounting height, per 2019 California Building Code, Section 1005.7.1 at Exception 1.

L. New buildings that are included in public schools (kindergarten through 12th grade) state funded projects and receiving state funding pursuant to Leroy F. Green, School Facilities Act of 1998, California Education Code Sections 17070.10 through 17079, and that are submitted to the Division of the State Architect for plan review after July 1, 2011 in accordance with the Education Code 17075.50, shall include locks that allow doors to classrooms and any room with an occupancy of five or more persons to be locked from the inside. The locks shall conform to the specification and requirements found in Section 1010.1.9. 2019 California Building Code Section 1010.1.11

Exceptions:

1. Doors that are locked from the outside at all times such as, but not limited to, janitor's closet, electrical room, storage room, boiler room, elevator equipment room and pupil restroom.
2. Reconstruction projects that utilize original plans in accordance with California Administrative Code, Section 4-314.
3. Existing relocatable buildings that are relocated within same site in accordance with California Administrative Code, Section 4-314.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Listed acceptable alternate manufacturers: these will be considered; submit for review products with equivalent function and features of scheduled products.

ITEM:	MANUFACTURER:	ACCEPTABLE ALTERNATE:
Hinges	(IVE) Ives	Stanley
Continuous Hinges	(IVE) Ives	Pemko
Key System	(SCH) Schlage	District Standard
Mechanical Locks	(SCH) Schlage	District Standard
Electronic Locks	(SCE) Schlage Electronics	District Standard
Exit Devices	(VON) Von Duprin	District Standard
Closers	(LCN) LCN	District Standard
Auto Flush Bolts	(IVE) Ives	DCI
Coordinators	(IVE) Ives	DCI
Silencers	(IVE) Ives	Rockwood, Trimco
Push & Pull Plates	(IVE) Ives	Rockwood, Trimco
Kickplates	(IVE) Ives	Rockwood, Trimco
Stops & Holders	(IVE) Ives	Rockwood, Trimco
Overhead Stops	(GLY) Glynn-Johnson	ABH
Thresholds	(ZER) Zero	NGP, Pemko
Seals & Bottoms	(ZER) Zero	NGP, Pemko

2.2 HINGING METHODS:

A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.

B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.

C. Conventional Hinges: Steel or stainless steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.

1. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins and security studs.
2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

D. Continuous Hinges:

1. Geared-type aluminum.

a) Use wide-throw units where needed for maximum degree of swing, advise architect if commonly available hinges are insufficient.
b) If units are used at storefront openings, color-coordinate hinge finish with storefront color. Custom anodizing and custom powdercoat finishes subject to Architect approval.

2. Pinned steel/stainless steel type: continuous stainless steel, 0.25-inch diameter stainless-steel hinge pin.

a) Use engineered application-specific wide-throw units as needed to provide maximum swing degree of swing, advise architect if required width exceeds 8 inches.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS:

A. Mortise Locksets and Latchsets: as scheduled.

1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
2. Universal lock case – 10 functions in one case.
3. Floating mounting tabs automatically adjusts to fit a beveled door edge.
4. Latchbolts: 0.75 inch throw stainless steel anti-friction type.
5. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.

a) Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
b) Inside lever applied by screwless shank mounting – no exposed trim mount screws.
c) Levers rotate up or down for ease of use.
d) Vandalgard locks: locked lever freely rotates down while remaining securely locked. This feature prevents damage to internal lock components when subjected to excessive force.

6. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
7. Turnpieces: accessible offset turn-lever design not requiring pinching or twisting motions to operate.
8. Deadbolts: stainless steel 1-inch throw.
9. Electric operation: Manufacturer-installed continuous duty solenoid.
10. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
11. Scheduled Lock Series and Design: Schlage L series, 06N design.

12. Certifications**:**

    a) ANSI A156.13, Grade 1 Operational.
    b) ANSI/ASTM F476-84 Grade 31 UL Listed.

13. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2019 11B-404.2.7 and 11B-309.4.

2.4 EXIT DEVICES / PANIC HARDWARE

A. General features**:**

1. Independent lab-tested 1,000,000 cycles.
2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. Deadlocking latchbolts, 0.75 inch projection.
4. End caps**:** impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
5. No exposed screws to show through glass doors.
6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
7. Releasable in normal operation with 15-pound maximum operating force per UBC Standard 10-4, and with 32-pound maximum pressure under 250-pound load to the door.
8. Exterior doors scheduled with XP-series devices**:** Static load force resistance of at least 2000 pounds.
9. Accessibility: Require not more than 5 lb to retract the latchbolt, per CBC 2019 11B-404.2.7 and 11B-309.4.

    a) Mechanical method: Von Duprin “AX-“ feature, where touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.
    b) Electrical method: Von Duprin’s “RX-QEL-“, where lightly pressing the touchpad with 5 lb or less of force closes an electric switch, activating quiet electric latch retraction.

B. Specific features**:**

1. Non-Fire Rated Devices**:** cylinder dogging with indicator.
2. Lever Trim**:** breakaway type, forged brass or bronze escutcheon min. 0.130 inch thickness, compression spring drive, match lockset lever design.
3. Fire-Labeled Devices**:** UL label indicating “Fire Exit Hardware”. Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.
4. Electrically Operated Devices**:** Single manufacturer source for electric latch retraction devices, electrically controlled trim, power transfers, power supplies, monitoring switches and controls.
5. Removable Mullions**:** Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.
6. Accepted substitutions: None, District Standard.

2.5 CLOSERS

A. Surface Closers**:** 4041XP

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 10,000,000 cycles.
4. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
6. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2016 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
    a) Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
8. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
9. Exterior door closers**:** tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
10. Exterior doors**:** seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.
11. Non-flaming fluid, will not fuel door or floor covering fires.
12. Pressure Relief Valves (PRV) not permitted.
13. Accepted substitutions: None, District Standard.

2.6 OTHER HARDWARE

A. Automatic Flush Bolts**:** Low operating force design.

B. Overhead Stops**:** Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

C. Kick Plates**:** Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

D. Door Stops**:** Provide stops to protect walls, casework or other hardware.

1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.
2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum**:** 90deg stop / 95deg deadstop. Note degree of opening in submittal.

E. Seals: Four-fingered type at head & jambs. Inelastic, rigid back, not subject to stretching. Self-compensating for warp, thermal bow, door settling, and out-of-plumb. Adhesive warranted for life of installation.

1. Proposed substitutions: submit for approval.
2. Three-fingered type at hinge jambs of doors fitted with continuous hinges where jamb leaf of hinge is fastened to the frame reveal.

F. Automatic door bottoms: low operating force units. Doors with automatic door bottoms plus head and jamb seals cannot require more than two pounds operating force to open when closer is disconnected.

1. Include automatic type door bottoms, as opposed to fixed sweeps, at stairs and elevator lobbies to allow fine-tuning of pressurization systems.

G. Thresholds: As scheduled and per details. Comply with CBC 2019 11B-404.2.5. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.

2. Saddle thresholds: 0.125 inches minimum thickness.
3. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".
4. Fire-rated openings, 90-minutes or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, include a 0.25in high 5in wide saddle in the bid, and request direction from Architect.
5. Fire-rated openings, 3-hour duration: Thresholds, where scheduled, to extend full jamb depth.
6. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
7. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.

H. Through-bolts: Do not use. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.

1. Exception: surface-mounted overhead stops, holders, and friction stays.

I. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent: door bears against silencers, seals make minimal contact with minimal compression – only enough to effect a seal.

2.7 FINISH:

A. Generally: BHMA 626 Satin Chrome.

B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

2.8 KEYING REQUIREMENTS:

A. Key System: Verify with Owner. Schlage Primus high-security utility-patented keyway, interchangeable core throughout. Utility patent protection to extend at least until 2029. Key blanks available only from factory-direct sources, not available from after-market keyblank manufacturers. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner to determine system keyway(s), keybow styles, structure, stamping, degree of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Contractor will install permanent cylinders/cores.

1. Existing factory-registered master key system.
2. Primus Level 9 (verify)
3. Construction keying: furnish temporary keyed-alike cores. Remove at substantial completion and install permanent cylinders/cores in Owner's presence. Demonstrate that construction key no longer operates.
4. Temporary cylinders/cores remain supplier's property.
5. Furnish 10 construction keys.
6. Furnish 2 construction control keys.
7. Furnish 2 Emergency keys per each L9485 Faculty Restroom Lock
8. Key Cylinders: furnish 6-pin solid brass construction.

B. Cylinders/cores: keyed at factory of lock manufacturer where permanent records are maintained. Locksets and cylinders same manufacturer.

C. Permanent keys: use secured shipment direct from point of origination to Owner.

1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
2. For estimate: VKC stamping plus "DO NOT DUPLICATE".

D. Bitting List: use secured shipment direct from point of origination to Owner at completion.

E. Key Control software: Include one Sitemaster 200 key control system with new key system.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS:

A. Can read and understand manufacturers' templates, suppliers' hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

3.2 PREPARATION:

A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.

1. Notify Architect of code conflicts before ordering material.
2. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1010.1.9.2 and 11B-404.2.7.
3. Locate panic hardware between 36 inches to 44 inches above the finished floor.

C. Overhead stops**:** before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

3.3 INSTALLATION

A. Install hardware per manufacturer’s instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.

1. Gaskets**:** install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
4. Replace fasteners damaged by power-driven tools.

B. Locate floor stops no more that 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.

C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.

D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.

E. Drill pilot holes for fasteners in wood doors and/or frames.

F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

3.4. ADJUSTING

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

1. Hardware damaged by improper installation or adjustment methods**:** repair or replace to Owner’s satisfaction.
2. Adjust doors to fully latch with no more than 1 pound of pressure.

a) Door closer valves: turn valves clockwise until at bottom – do not force. Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.

3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
4. Adjust door closers per 1.9 this section.

B. Inspection of fire door assemblies and means-of-egress panic-hardware doors**:** Per 2016 NFPA-80 5.2.1: hire an independent third-party inspection service to prepare a report listing these doors, and include a statement that there are zero deficiencies with the fire-rated assemblies and the openings with panic hardware.

C. Fire-rated doors**:**

1. Wood doors**:** adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.
2. Steel doors**:** adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.
3. Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.

D. Final inspection**:** Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following**:**

1. Has re-adjusted hardware.
2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
3. Has identified items that have deteriorated or failed.
4. Has submitted written report identifying problems.

3.5 DEMONSTRATION**:**

A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

3.6 PROTECTION/CLEANING**:**

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.7 SCHEDULE OF FINISH HARDWARE

A. See door/gate schedule in drawings for hardware set assignments.

B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.

C. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

HARDWARE GROUP G101

For use on Gates: G101, G102, G103

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	GATE HINGE	BY GATE MFGR/SUPPLIER		
1	EA	ACCESSIBLE FORK LATCH	BY GATE MFGR/SUPPLIER		
1	EA	PADLOCK	PADLOCK CAMPUS STANDARD		SCH

HARDWARE GROUP G102

For use on Gates: G104, G105

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	PANIC HARDWARD	CDSI-PA-AX-98-NL-OP-110MD-WH	626	VON
1	EA	RIM CYLINDER	CAMPUS STANDARD	626	TBD
1	EA	DOOR PULL	VR910 NL	630	IVE LOX
1	EA	GATE CLOSER/HINGE	MAMOTH180-ZILV		LOX
1	EA	KICK PLATE	8400 10″X2″ LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE

NEW CYLINDER TO MATCH EXISTING CAMPUS STANDARD. CONSULT CAMPUS LOCKSMITH, GATE FABRICATOR TO PROVIDE HINGE REINFORCEMENT FOR HINGE CLOSER AND RIM PANIC REINFORCEMENT AND MOUNTING PLATE.

HARDWARE GROUP G103

For use on Gates: G106

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
2	EA	PANIC HARDWARD	CDSI-PA-AX-98-NL-OP-110MD-WH	626	VON
2	EA	RIM CYLINDER	CAMPUS STANDARD	626	TBD
2	EA	DOOR PULL	VR910 NL	630	IVE LOX
2	EA	GATE CLOSER/HINGE	MAMOTH180-ZILV		LOX
2	EA	KICK PLATE	8400 10″X2″ LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S	BLK	IVE

NEW CYLINDER TO MATCH EXISTING CAMPUS STANDARD. CONSULT CAMPUS LOCKSMITH, GATE FABRICATOR TO PROVIDE HINGE REINFORCEMENT FOR HINGE CLOSER AND RIM PANIC REINFORCEMENT AND MOUNTING PLATE.

END OF SECTION

SECTION 09 72 16

CUSTOM DIGITAL WALL COVERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Custom Digital Wall Covering.

1.02 SUBMITTALS

A. Submit samples of all materials specified. Do not order materials until approval is received.
   1. Submit "mini-mural" of complete finished image printed on actual substrate specified.
   2. Submit sample section of final image at 100% resolution printed on actual substrate specified.

B. Submit full size miniature strike-off for approval prior to the manufacturer of full size mural.

C. Manufacturer's Data: For each type of digital wall covering proposed for use. Submit certified copies of reports of tests specified, together with complete description of each wall covering, including: patter, total weight, fabric backing, tensile strength, tear strength, and fire hazard classification.

D. Submit Installer's qualifications and certification of experience.

1.03 QUALITY ASSURANCE

A. Imperfections such as engraving roller die marks, roller repeat marks or other features deemed not in conformance with the specified materials, are not acceptable.

B. Applicators Qualifications: Work of this section shall be performed by a firm regularly engaged in the installation of vinyl wall coverings of the types and qualities specified. Minimum experience 3 years.

1.04 PROJECT SITE CONDITIONS

A. Wall Condition:
   1. The wall surface should be clean, dry, structurally sound, and free of mildew, grease, dust, or other stains.
   2. Conform to manufacturer's recommendations for wall surface requirements.

B. Environmental Requirements: Conform to manufacturer's recommendations for environmental requirements and limitations.

1.05 WARRANTY

A. Submit manufacturer’s written five-year warranty against manufacturing defects.
   1. All wall covering materials when adhered to a sound surface with the manufacturer’s recommended procedures and adhesive, shall be warranted free of manufacturing defects for a period of 5 years from the date of acceptance of the project.
   2. Assuming no deterioration in the subsurface, if such manufacturing defects are claimed in writing during the warranty period, and proper documentation is presented to the manufacturer with regard to date of sale, plus adhesive used and surface applied to the manufacturer, as its option, will either replace the vinyl wall covering or refund the purchase price.

PART 2 - products

2.01 MANUFACTURERS

A. Riot Creative Imaging.

B. Or equal

2.02 MATERIALS

A. Digital Image: Printed on mylar film wall covering substrate using manufacturer's standard printing process with optional anti-graffiti laminate (glossy finish). Images shall be provided by Architect.
   1. Refer to Drawings for additional information.

B. Adhesive: Type as recommended by manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Examine surface for any imperfections. Repair surfaces acceptable to manufacturers. Verify surface conforms to manufacturer's recommendations. Beginning of installation means acceptance of substrate.

B. Install digital wall covering in accordance with the manufacturer’s instructions.

C. The wall covering shall be smoothed to the hanging surface, using a stiff bristled sweep brush or a flexible broad-knife to eliminate air bubbles.

D. Remove excess adhesive along finished seams immediately after each wall-covering strip is applied. Use clean warm water, a natural sponge, and clean towels. Change water often to maintain water cleanliness.

3.02 CLEAN-UP COMPLETION

A. Upon completion of the Work, remove surplus materials, rubbish and debris resulting from the wall covering installation. Leave areas in neat, clean and orderly condition.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Fluid applied paints and coatings. Upon completion of Work, all visible surfaces, within the Contract limits shall be painted unless scheduled "Not to Be Painted in this Section."
   1. Each paint system includes:
      a. Surface preparation, including touch-up of shop applied primers, if needed.
      b. Prime coat application, where scheduled as part of finish system.
      c. Finish coat application, where scheduled apply two or more finish coats.
   2. Paint semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines, behind wall-mounted items).
   3. Repair and Painting of existing surfaces.

B. Surfaces Not to be Painted:
   1. Prefinished wall, ceiling, and floor coverings.
   2. Items with factory-applied final finish .
   3. Concealed ducts, pipes, and conduit.
   4. Glass, plastic laminate, ceramic tile, anodized aluminum.
   5. Surfaces of steel items that will be embedded in concrete.
   6. Surfaces specifically scheduled or noted on the Drawings not to be painted.

C. Related Sections:
   1. Section 01 35 42, CALGreen Requirements.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM International - American Society for Testing and Materials
   1. ASTM D 4444 - Use and Calibration of Hand-Held Moisture Meters.
   2. ASTM D 6386 - Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

C. SCAQMD - South Coast Air Quality Management District: SCAQMD-1113 - Rule 1113, Architectural Coatings.

D. SSPC - Steel Structures Painting Council.

1.03 SUBMITTALS

A. Product Data: For each paint system product and accessory item.

B. Samples: Of each specified finish system color, texture, and sheen; samples shall be minimum 8-1/2 by 11 inches in size.

C. Certified copies of moisture test results.

D. Informational Submittals:
   1. Statement of Qualifications from manufacturer.
   2. Statement of Qualifications from installer.
   3. Manufacturer’s application instructions.

E. Closeout Submittals
   1. Material Safety Data Sheets.

F. Submit Qualifications data for manufacturer and applicator required under Quality Assurance.

1.04 MAINTENANCE MATERIALS AND SUBMITTALS

A. For each color, type, and gloss of paint used in the work provide, as Extra Materials, a quantity equal to approximately 10 percent of the quantity required for its installation rounded to the nearest gallon, or five gallons, whichever is less.
   1. Extra Materials shall be from the same production run as installed materials.
   2. Label each container with locations and dates of related installations; do not obscure manufacturer’s label.
   3. Deliver Extra Materials to Site as directed by Owner.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Company with minimum 10-years' experience manufacturing quality paint and finish products for commercial projects similar in scale and complexity to those required for this Project.

B. Applicator Qualifications: Company with minimum 5-years' experience painting and finishing commercial projects similar in scale and complexity to those required for this Project.

C. Materials, for each paint system, shall be by, or as recommended by, a single coating manufacturer for use together in commercial quality paint / coating system for the substrate and exposure conditions indicated.

D. Regulatory Requirements
   1. Conform to SCAQMD-1113 for maximum VOC limits.
   2. Comply with applicable codes and regulations of authorities having jurisdiction including those with jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

E. Field Samples: Provide Field Sample of each finish system color, texture, and sheen scheduled. Do not proceed with coating application until sample panel has been approved.

1. Field Sample shall be full height of wall by 10-feet.
2. Locate as approved by Architect.
3. Adjust materials and methods of installation as required to obtain Architect's approval.
4. Document materials and methods used to obtain Architect’s approval and maintain at least one copy of this documentation on site while related work is in progress.
5. Maintain access to and protect Field Sample from damage while related work is in progress.
6. Upon acceptance of related work, approved sample may remain as part of Work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in their original, sealed, undamaged containers with labels intact and legible.
   1. Labels shall include manufacturer’s name, type of paint, brand name, brand code, color designation, recommended surface preparation, typical coverage, drying times, cleanup procedures, and instructions for mixing and reducing, if permitted.

B. Store paint materials ambient temperatures between 45- and 90-degrees F, in well ventilated area unless permitted otherwise by manufacturer’s instructions.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.07 FIELD CONDITIONS

A. Supply continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45-degrees F for 24-hours before, during and 48-hours after application of finishes, unless permitted otherwise by manufacturer’s instructions.

B. Do not apply exterior coatings during rain, or when relative humidity is above 50 percent, unless permitted otherwise by manufacturer’s instructions.

C. Minimum application temperatures for Latex Paints: 50-degrees F for exterior; unless required otherwise by manufacturer’s instructions.

D. Maintain lighting level sufficient to conduct painting operations.

1.08 GUARANTEE

A. Guarantee the painting Work against peeling, fading, cracking, blistering or crazing for a period of two years form the Date of Certified Completion for painting of new surfaces and existing surfaces.

PART 2 - PRODUCTS

2.01 PAINTS AND COATINGS

A. Acceptable Manufacturers: Products of following manufacturers form basis for design and quality intended.
   1. Vista Paint Corporation, Fullerton, CA.
   2. Behr Process Corporation, Santa Ana, CA.
   3. Dunn-Edwards Corporation, Los Angeles, CA.
   4. Sherwin-Williams Company, Cleveland, OH.
   5. Kelly-Moore Paint Company Inc., San Carlos, CA.
   6. PPG Paints, Pittsburg, PA.
   7. Tnemec Company Inc., Kansas City, MO.
   8. Carboline Company, St. Louis, MO.
   9. Rust-Oleum Corporation, Somerset, NJ.
   10. Benjamin Moore and Co., Montvale, NJ.
   11. McCloskey, Wheeling, IL.
   12. Cabot, Newburyport, MA.

B. Or equal, approved in accordance with Division 01, General Requirements, for substitutions.

2.02 MATERIALS

A. Coatings: Ready mixed, except field-catalyzed coatings. Process pigments to soft past consistency, capable of being readily and uniformly dispersed to homogenous coating.

B. Colors and Glosses: As scheduled in Section 09 06 00. Architect will select color and hue to be used in various types of paint specified and will be sole judge of acceptability of various glosses obtained from materials proposed to be used in Work. During actual painting, Architect may make minor modifications in tone and shade to adjust for actual surface and lighting conditions encountered.

C. Undercoats and Thinners: Provide undercoat paint produced by same manufacturer as finish coat. Use only thinners recommended by paint manufacturer and use only to recommended limits. Use undercoat, finish coat and thinner material as parts of a unified system of paint finish.

D. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.

E. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified of commercial quality.

2.03 APPLICATION EQUIPMENT

A. For application of the approved paint, use only such equipment as is recommended by the manufacturer.

B. Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by the use of the proposed application equipment.

2.04 FINISHES

A. Refer to schedule at end of Section for surface finish and Section 09 06 00. Notwithstanding product numbers listed in schedule, Contractor shall conform to most recent product numbers as published by the manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.

C. Measure moisture content of new surfaces using an electronic moisture meter. Apply finishes only when moisture content of surfaces are below the following maximums. Conduct moisture measurements in presence of the project inspector, document readings and submit to Architect under Part 1.

D. Beginning installation means acceptance of existing surfaces and conditions.

3.02 MATERIALS PREPARATION

A. Mix and prepare painting material in accordance with manufacturer's recommendations.

B. Store materials not in actual use in tightly covered containers.

C. Maintain containers used in storage, mixing and application of paint in a clean condition, free from foreign materials and residue.

D. Stir all materials before application to produce a mixture of uniform density and as required during the application of materials. Do not stir into the material any film that may form on the surface. Remove the film and strain the material before using.

3.03 SURFACE PREPARATION

A. Remove electrical plates, hardware, light fixture trim and fittings prior to preparing surfaces for finishing.

B. Correct minor defects and clean surfaces which surfaces which affect Work of this section.

C. Shellac and seal marks that may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Surface Preparation for Exterior Metal (Except Galvanized): Preparation in accordance with SSPC-6 Commercial Blast Cleaning.

F. Galvanized Surfaces:
   1. Prepare galvanized steel and nonferrous metal surfaces in accordance with SSPC-SP16 Brush Off Blast Cleaning Method for Coating and Uncoated Galvanized Steel and Non Ferrous Metals OR ASTM D 6386-Surface Preparation of Galvanized Surfaces, and as well as manufacturer™™s instructions.
   2. Ensure surfaces are dry.
   3. Interior Exposure (Dry/Benign): Remove visible, oil, grease, dirt, dust, protective mill coatings, and other soluble contaminants in accordance with SSPC-SP 1 or manufacturer™™s instructions as specified for coating system. Hand or Power tool clean to remove all insoluble contaminants.
   4. Interior and Exterior Exposure (moderate to severe): Remove visible oil, grease, dirt, dust, protective mill coatings, and other soluble contaminants in accordance with SSPC-SP 1 or manufacturer™™s instructions as specified for coating system. Follow initial cleaning with one of the following Methods:
      a. SURFACE PREPARATION METHOD A (Preferred): Prepare Galvanized Steel to be painted according to SSPC-SP16 Brush Off Blast Cleaning for Coated and Uncoated Galvanized Steel and Non Ferrous Metals OR Thoroughly roughen the entire surface to be coated using compressed air brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1-2 mils. reference ASTM D 6386-99 Section 5.4.1.
      b. SURFACE PREPARATION METHOD B (Alternative method when Method A is not feasible): Chemically Treat with one of the following products to etch the galvanized surface to be coated: Henkel Galvaprep 5 or Clean ˜˜n Etch by Great Lakes Laboratory. Reference ASTM D 6386-99 Section 5.4.2.

G. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime paint after repairs with Tnemec Series L69 Hi Build Epoxoline II or Carboline 890 VOC or approved in accordance with Division 01, General Requirements for Substitutions.

H. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Spot prime bare steel surfaces to match existing primer.

I. Door and Window Frames, Side Lights, Jambs and Headers: clean and light sand smooth.

J. Previously Coated Surfaces: Painting over existing painted surfaces interior and exterior, ascertain that new paint system is compatible with existing gloss and high-gloss oil-based paint system to insure proper adhesion. Sand lightly existing paint and prime walls as scheduled.

3.04 PROTECTION

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

B. Repair damage to other surfaces caused by Work of this Section.

C. Furnish drop cloths, shields and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.05 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish. Number of coats specified is a minimum. Additional coats shall be applied at no extra cost, if coatings show evidence of uneven application, uneven pigmentation, brush strokes or otherwise unsatisfactory distribution of material.

D. Under coats shall be lighter and brighter in tint that finish coat.

E. Sand lightly between coats to achieve required finish.

F. Allow applied coat to dry before next coat is applied.

G. Paint Frames: Split paint door frames to match color of walls on each side of opening unless directed otherwise by Architect.

3.06 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Collect cotton waste, cloths, and material that may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.07 SPECIAL COATING SYSTEMS

A. High Performance Coatings (Special Coatings): Exterior; metal handrails, railings, guardrails, roof sheet metal flashings, galvanized structural steel, structural steel, Architecturally Exposed Structural Steel (AESS), and as indicated. Total 5.0 to 8.5 mil thickness, as recommended by the manufacturer. Colors to be selected by Architect. Prepare surfaces and apply finishes per manufacturer's specifications.
   1. Unprimed or Shop Primed - Ferrous - Gloss - Polyurethane:
      a. Primer, 1 Coat
         1) PPG Amerlock 2 VOC
         2) Tnemec L69
         3) Sherwin Williams B58-620
         4) Carboline Carbomastic 15
      b. Finish, 2 Coats
         1) PPG Amerishield VOC
         2) Tnemec 1080
         3) Sherwin Williams B65-625
         4) Carboline Carbothane 134 MC
   2. Unprimed or Shop Primed - Ferrous - Semi-Gloss - Polyurethane:
      a. Primer, 1 Coat
         1) PPG Amerlock 2 VOC
         2) Tnemec L69
         3) Sherwin Williams B58-620
         4) Carboline Carboguard 890 VOC
      b. Finish, 2 Coats
         1) PPG Amershield VOC
         2) Tnemec 1081
         3) Sherwin Williams B65-630
         4) Carboline Carbothane 133 VOC
   3. Galvanized or Aluminum - Gloss - Polyurethane:
      a. Primer, 1 Coat
         1) PPG Amerlock 2 VOC
         2) Tnemec L69
         3) Sherwin Williams B58-620
         4) Carboline Galoseal WB
      b. Finish, 2 Coats
         1) PPG Amerishield VOC
         2) Tnemec 1080
         3) Sherwin Williams B65-625
         4) Carboline Carbothane 134 MC
   4. Galvanized or Aluminum - Semi-Gloss - Polyurethane:
      a. Primer, 1 Coat
         1) PPG Amerlock 2 VOC
         2) Tnemec L69
         3) Sherwin Williams B58-620
         4) Carboline Carboguard 890 VOC
      b. Finish, 2 Coats
         1) PPG Amerishield VOC
         2) Tnemec 1081
         3) Sherwin Williams B65-630

4) Carboline Carbothane 133 MC

END OF SECTION

SECTION 10 14 00

IDENTIFICATION SIGNS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Plastic Signs, raised character, tactile, room identification, and non-tactile signs.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. American Society for Testing and Materials (ASTM)
   1. ASTM D4802 - Poly (Methyl Methacrylate) Acrylic Plastic Sheet

C. ADA - Americans with Disabilities Act of 1990 as amended.
   1. ADA/Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

D. CBC - 2019 California Building Code (CBC)
   1. Chapter 10, Egress Requirements
   2. Chapter 11B, Accessibility for Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing

E. CFC - 2019 California Fire Code.

F. California Code of Regulations (CCR)
   1. CCR 19-3 - Title 19, Chapter 3

G. AMS Standard 595A.

1.03 SUBMITTALS

A. Shop Drawings of each sign, indicating lettering styles and locations and overall dimensions.

B. Three sample, full size, signs, with different messages of types, styles and colors specified including method of mounting. If accepted, samples may be installed in Project.

C. Manufacturer's Installation Instructions

D. Lettering Samples: 1-inch high, uppercase I, and O letters in each font specified, for required Quality Assurance testing.

1.04 QUALITY ASSURANCE

A. Pre-Installation Conference
   1. Notify Architect 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.
   2. Provide signs from one manufacturer, unless otherwise approved.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site and protect from damage. Store until immediately prior to Notice of Completion.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Signage and Graphics:
   1. Raised characters shall comply with CBC Section 11B-703.2
      a. Depth: It shall be 1/32-inch minimum above their background and shall be sans serif uppercase and be duplicated in Braille.
      b. Height: It shall be 5/8-inch minimum and 2 inches maximum based on the height of the uppercase letter "I". CBC Section 11B-703.2.5.
      c. Finish and contrast: Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. CBC Section 11B-703.5.1
      d. Proportions: It shall be selected from fonts where the width of the uppercase letter "O" is 60% minimum and 110% maximum of the height of the uppercase letter "I". Stroke thickness of the uppercase letter "I" shall be 15% maximum of the height of the character. CBC Section 11B-703.2.4 and 11B-703.2.6.
      e. Character Spacing: Spacing between individual raised characters shall comply with CBC Section 11B-703.2.7 and 11B-703.2.8.
      f. Format: Text shall be in a horizontal format. CBC Section 11B-703.2.9.
      g. Braille: It shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4. Braille dots shall have a domed or rounded shape and shall comply with CBC Table and Figure 11B-703.3.1.
      h. Mounting height: Tactile characters on signs shall be located 48" minimum to the baseline of the lowest Braille cells and 60" maximum to the baseline of the highest line of raised characters above the finish floor or ground surface. CBC Section and Figure 11B-703.3.4.1.
      i. Mounting location: A tactile sign shall be located per CBC Section and Figure 11B-703.4.2 as follows:
         1) Alongside a single door at the latch side.
         2) On the inactive leaf at double doors with one active leaf.
         3) To the right of the right hand door at double doors with two active leafs.

4) On the nearest adjacent wall where there is no wall space at the latch side of a single door or at the right side of double doors with two active leafs.
5) So that a clear floor space of 18" x 18" minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.

2. Visual characters shall comply with CBC Section 11B-703.5 and shall be 40" minimum above finish floor or ground.
3. Pictograms shall comply with CBC Section 11B-703.6.
4. Symbols of accessibility shall comply with CBC Section 11B-703.7.
5. Variable message signs shall comply with CBC Section 11B-703.8.

2.02 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
1. Mohawk Sign Systems, Inc., Schenectady, NY.
2. Roemer Industries, Masury, OH.
3. ASI Modulex, Inc., Dallas, TX.
4. Vomar Products.
5. Apco Signs, Atlanta, GA.
6. Nelson-Harkins Industries, Inc.
7. Mathews International Corporation
8. Vista System
9. Diverse Signs Ltd.

B. Or approved equal in accordance with Division 01 General Requirements for substitutions.

2.03 PLASTIC SIGN MATERIALS

A. Tactile Plastic Sign Materials: Thermosetting high pressure laminate.

B. Non-Tactile Signs: Acrylic Plastic Sheet: ASTM D4802, Category A-1, 1/4 inch overall thickness, laminated acrylic plastic sheets.

2.04 SIGN FABRICATION - GENERAL

A. Plastic Signs
1. Tactile and Braille Copy: Sand-Carved signs; thermosetting high pressure laminate using Graphic Process Sand-Carved signs, with square corners, UNO, and square cut edges, exterior-grade. Graphics, Braille and tactile copy required.
a. Unframed Signs: Mohawk 1000 ADA System signs, Series 200A, Design M-311 or Design M310A/B window plaques where indicated, by Mohawk Sign Systems or equal. Custom copy by Architect.
2. Non-tactile Plastic Signs: 1/4 inch overall thickness, laminated acrylic plastic sheets, using sub-surface screen-print process graphics and symbols, exterior-grade at exterior locations, 3/8-inch square corners, UNO, square cut edge, drilled holes for countersunk screws, polished edges.
a. Unframed Signs.

3. Apply UV inhibitor overcoat for exterior signs.

B. Fasteners: Stainless steel screws, flat head, pin-in-head torx screws for vandal-proof and clear silicone adhesive.

C. Lettering Type Style: Helvetica Regular, uppercase letters only, refer to QUALITY ASSURANCE for letter-proportion compliance.

D. Colors: As selected by Architect.

2.05 ROOM IDENTIFICATION SIGNS

A. Room Identification Signs: raised character, tactile plastic signs.

B. Size: 2-1/2 inches high, minimum, by 8 inches long, with 7/8 inch high, letters minimum 1/32 inch thick, minimum 3/32 inch thick for metal signs, fully tactile, with BRAILLE indicator.
1. Provide one sign with up to 13 letters for each door.
2. Provide one sign with up to 3 numerals for each door.

2.06 OCCUPANT LOAD SIGNS

A. Posting of occupant load signage in each room or area use for assembly per CBC 1004.3, CFC & Title 19.

B. Provide maximum occupancy load signs. Post in a conspicuous place near main exits or exit-access doorway of following areas:
1. Grandstands

C. Material:
1. Non-Tactile Signs: Acrylic Plastic Sheet: ASTM D4802, Category A-1.
   a. Overall thickness of 1/4 inch, colors as selected by Architect.
   b. Upper Layer: Non-glare clear acrylic 1/8 inch thick.
   c. Lower Layer: Opaque acrylic, 1/8 inch thick.
   d. Polished edges.

D. Size: 4 inches high by 8 inches, minimum, long, sub-surface application, 7/8 inch high letters, and 1 inch high numbers.
1. Message: MAXIMUM OCCUPANCY LOAD ###
2. Occupant load number as indicated on Drawings.
3. Conform to Sections 1004.3 California Building Code.

2.07 ASSISTIVE LISTENING DEVICE SIGNS

A. Locations as indicated on Drawings. Per CBC Section 11B-216.10, 11B-703.5 and fig. 11B-703.7.2.4.

B. Include International Symbol of Access for Hearing Loss and with text "Assistive-listening System Available", signs per 11B-703.5. Prior arrangements must be made for events after normal business hours.

2.08 ACCESSIBILTY SIGNS AT GRANDSTANDS

A. International Symbol of Accessibility: Provide International Symbol of Accessibility sign for each disabled-person location, attached to front of bleacher [and seating] in truncated area. If two wheelchair areas are provided provide one sign each.

B. Companion Seat Sign: Provide one sign with text "RESERVED FOR COMPANION SEATING" for each disabled person location, attached to front of first row of bleachers.

C. Acrylic sign: 6" x 6" x 1/4" overall thickness, 7/8 inch high letters, min.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive Work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

A. Install signs only after surfaces are finished, install at all rooms.
   1. At single-leaf doors, locate signs on wall adjacent to latch side of applicable door opening, centered horizontally within 18-inch space adjacent to latch side of door, 60 inches from finish floor to center line of sign. Mounting location shall be located so that a clear space of 18" minimum by minimum by 18" minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position. CBC Section 11B-703.4.2.

B. Mounting
   1. Tactile Plastic Signs: Stainless steel screws, pin torx, vandal-proof.
   2. Non-tactile Plastic Signs:
      a. Install with four (4) stainless steel countersunk flathead screws, pin torx, vandal-proof. Pre-drill holes to prevent breaking plastic, use countersunk drill bits to flush screw head with sign surface.

C. For signs installed on glass: a blank vinyl backer is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.

D. Clean and polish signs following manufacturer’s instructions.

3.03 FIELD QUALITY CONTROL

A. DSA Inspections: Signs and identifications or other information shall be field inspected after installation and approved by Division of the State Architect prior to the issuance of a final certificate of occupancy, or final approval where no certificate of occupancy is issued. The inspection shall include, but not limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with CBC, Section 11B-703.1.1.2.

3.04 SIGN TYPES AND SCHEDULE

A. As indicated on Drawings.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aluminum flagpoles.
   1. Ground Set.

B. Halyard, accessories and flags.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. AASHTO M-36 - Corrugated Steel Pipe, Metallic Coated, for Sewers and Drains.

C. ASTM B241 - Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

1.03 SYSTEM DESCRIPTION

A. Performance: Pole with flag flying (flagged windspeed): Resistant without permanent deformation, 100 mph windspeed, non-resonant.

B. Pole Design: Tapered Cone, one piece.

C. Ground Set
   1. Type: External Halyard System, with ground sleeve.
   2. Nominal Height: 30 feet, measured from top of base or as noted in the drawings.

1.04 SUBMITTALS

A. Shop drawings showing, detailed dimensions, base attachment details, anchor requirements and imposed loads.

B. Product data on pole, accessories and configurations.

C. Three samples illustrating shaft material, color and finish.

D. Manufacturer's installation instructions.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store and protect products.

B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

C. Protect flagpole and accessories on site from damage or moisture.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
1. American Flagpole, Abingdon, VA.
2. Concord Industries, Inc., Addison, TX.
3. Morgan - Francis Div., Rushville, IN.
4. Eder Flagpole Co., Oak Creek, WI.
5. Pole Tech, Inc., Holbrook, NY.

B. Or equal as approved in accordance with Division 01 General Requirements for substitutions.

2.02 POLE MATERIALS

A. Aluminum: ASTM B241; 6063 alloy, T6 temper.

2.03 COMPONENTS AND ACCESSORIES

A. Finial: Aluminum ball, 6 inch diameter, min.

B. Flags: [USA design] [and State of California Design] [and School Design] Size: [5 by 8] [6 by 10 max. size], feet nylon fabric.

C. Halyard: 5/16"", #10 multi-filament polypropylene, braided, waterproof, white, with snap hooks.

D. Truck Assembly
1. Ground Set: Cast aluminum; revolving single sheave External Halyard.

E. Cleats:
1. External Halyard: One (1) 9" aluminum cleat, side of pole with cleat cover and cylinder lock, keyed to building standard.

2.04 MOUNTING COMPONENTS

A. Ground Set:
1. Foundation Tube Sleeve: AASHTO M-36, corrugated 16 gauge steel, 10 inches diameter, galvanized, with steel base plates with grounding spike and metal centering wedges.
2. Flash collar: Spun aluminum finish to match pole finish.

B. Tamping sand: screened dry sand.

C. Concrete footing: 3000 psi concrete, per Division 32.

D. Lightning Ground Rod: 18 inch long copper rod, 3/4 inch.

2.05 POLE FABRICATION

A. Outside Butt Diameter: 6 inches.

B. Outside Tip Diameter: 3-1/2 inches.

C. Nominal Thickness:
1. Butt: 0.188 inches.
2. Tip: 0.188 inches.

2.06 FINISHES

A. Concealed Steel Surfaces: Galvanized to 1.25 ounces per square feet.

B. Ball: Gold anodized to 0.7 mil thickness.

C. Pole and Flash Collar: Clear anodized to 0.7 mil thickness.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.
1. Concrete foundation and reinforcing for cast-in-place Foundation Tube Sleeve (corrugated): Per Division 32, install per manufacturer's recommendations. Minimum 3000 psi concrete, 3'-6" deep by 30" diameter at top tapered down to 24", with sloped to drain top of concrete unless shown to flush with adjacent surface.

B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install flagpole as indicated on Drawings and in accordance with manufacturer's instructions.

B. Install grounding rod as indicated on Drawings and in accordance with manufacturer's instructions.

C. Cleat Mounting: 48 inches (maximum) above finish surface.

3.03 TOLERANCES

A. Maximum Variation From Plumb: One inch.

3.04 ADJUSTING AND CLEANING

A. Clean surfaces.

B. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 11 66 00

ATHLETIC AND PLAYGROUND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Equipment as scheduled

B. Installation of required concrete footings and reinforcing.

C. Related Sections:
1. Section 09 90 00, Painting
2. Section 11 68 43, Scoreboards
3. Division 26 Electrical

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ADA - Americans with Disabilities Act of 1990 as amended.
1. ADA/Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

C. CBC - 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA.):
1. CBC-11B - CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing.

D. National Federation of State High School Associations (NFHSA).

1.03 SUBMITTALS

A. Shop drawings, plan layout of equipment, footings, mounting bolt dimensions, anchorages, power requirements, [wiring diagrams] and related installation details for each type of equipment specified.

B. Product data on operating equipment, characteristics, and limitations.

C. Product data.

D. Three samples of materials and finishes.

E. Manufacturer's installation instructions.

F. Operation and maintenance data. Including data for maintaining operating equipment, type and frequency of lubrication, general instructions for maintaining finishes and prevention of deterioration.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in equipment with five years of experience.

1.05 PRODUCT HANDLING AND DELIVERY

A. Materials delivered to the site shall be examined for damage or defects in shipping. Any defects shall be noted and reported to the Architect.

B. Sound materials shall be stored above the ground under protective cover or indoors to provide proper protection.

1.06 WARRANTY

A. Submit in accordance with Division 01 General Requirements.

B. Provide a limited 2-Year Warranty Date of Certified Completion on all equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
1. Sportsfield Specialties Inc. Delhi, NY.
2. Porter Athletic Equipment Company, Chatsworth, CA.
3. Jaypro Sports Inc., Waterford, CT.
4. PW Athletic Equipment, Prescott AZ.

B. Or equal, approved in accordance with Division 01, General Requirements, for substitutions.

2.02 MATERIALS

A. Concrete for Footings: as specified in Section 32 13 13 with minimum 3000 psi compressive strength at 28 days and maximum 4-inch slump at placement.

B. Reinforcing Steel: 32 13 13, uncoated finish. Provide cage reinforcement of No. 5 deformed bars, unless noted otherwise on drawing.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that structural supports, anchor bolts and backing are ready to receive work.

B. Verify that proper power supply is available.

C. Beginning of installation means acceptance of existing surfaces.

3.02 INSTALLATION

A. Install systems and components in accordance with manufacturer's instructions.

B. Support and anchor equipment and component assemblies per manufacturer’s instructions.

C. Install concrete footings according to manufacturer's details including steel reinforcing. Refer to Section 32 13 13.

D. All sleeves required for athletic equipment installation shall be set plumb and true to line and grade in concrete as indicated on the drawings and per manufacturer's recommendation.

E. All athletic equipment shall be installed in strict accordance with the latest rules, regulations and specifications governing that sport or event in which it is being installed for.

3.03 TEST AND ADJUST

A. Test and adjust systems for proper function.

3.04 INSTRUCTIONS/TRAINING TO OWNER'S PERSONNEL

A. Instruct Owner’s personnel in proper operation and maintenance of all systems, equipment and similar items which were provided as part of Work.

B. Contractor shall provide schedule to Owner for approval for each of instruction periods required. Total hours of training, not less than 1 hour for each individual equipment specified or scheduled.

C. Instruction sessions will be held in Owner designated area on project site and at Owner’s convenience.

D. Instructors shall be qualified by product manufacturer in subject matter presented at training session.

3.05 SCHEDULE FOR EXTERIOR EQUIPMENT

A. Football Goal Posts: Sportsfield Specialties or equal.
   1. Single Ground Sleeve Insert Gooseneck Support: Fabricated of 6" Schedule 40 Aluminum Pipe (6.625" O.D.), 5' Radius, 8' Offset, Custom Offsets Available
   2. Ground Sleeve: Fabricated of 8" Schedule 40 Steel Pipe (8" I.D.)
      a. Length: 60"

   3. Crossbar: Fabricated of 6" Schedule 40 Aluminum Pipe (6.625" O.D.)
      a. Length: 23'-4" - High School

b. Includes Patented AdjustRight feature allowing for easy installation through the adjustment of an internal locking rotating sleeve at both the gooseneck/crossbar and upright/crossbar connections. This adjustment can easily be repeated throughout the life of the football goal post ensuring proper alignment of all components for years of competition and all with the added benefit of no exposed hardware on the face of the goal. Thermal arc sprayed internal textured mating surfaces and anti-vibration enhancements such as serrated washers and nyloc coated bolt ends ensure the AdjustRight Football Goal Posts remain in position.

4. Uprights: Fabricated of Extruded 6061-T6 Aluminum Tube (4" O.D.) with Rigid Wire Loop Welded to Upper End
   a. Length: 20'
5. Powder Coated Finish: Yellow or White
6. Installation Package Consisting of the Following Components:
   a. Ground Sleeve
   b. Optional Access Frame Kit: 1/8" (0.125") Aluminum Construction with 1" PVC Drain Stub, Includes Two (2) Half Moon Filler Plugs, Optional Full Size Filler Plug and SG2S® Patented Soccer Goal Rear Bottom Ground Bar Retractable Safety Clamp System Available, Use GFAFIT for Synthetic Turf Installation Applications and GPAFNG for Natural Grass Installation Applications
7. Included Accessories:
   a. Directional Wind Flags
   b. Touch-up Paint (Powder Coat Finish Specific)
   c. Model Specific Hardware Kit and Installation Instructions

B. Football Goal Post Pad: Sportsfield Specialties or equal.
1. GPPR - Round Football Goal Post Pad
2. Dimensions: 18" Outside Diameter, 7" Inside Diameter, 6' Height
3. 5.5" Thick High Impact Polyurethane Foam
4. Outdoor Vinyl Encasement:
   a. High UV Resistance
   b. Total Weight: 18 oz./yd^2 (ASTM D3776)
   c. Construction: 84% Vinyl Coating, 16% Polyester Fabric (ASTM D751)
   d. Tongue Tear: Warp 93 lbs., Fill 68 lbs. (ASTM D751)
   e. Grab Tensile: Warp 232 lbs., Fill 213 lbs. (ASTM D751)
   f. Adhesion: Warp 28 lbs/in, Fill 40 lbs/in (ASTM D751)
   g. Abrasion: > 1000 Cycles (ASTM D3389-94)
   h. Cold Crack: -49° F (ASTM D2136)
   i. Rot, Mildew and Fungus Resistant: Yes
   j. Flame Resistance: None
   k. Various Standard Colors Available
5. Factory Sewn Hook and Loop Vertical Closure
6. 1-Year Manufacturer’s Limited Product Warranty
7. Optional
   a. Custom High-Resolution Digitally Printed Graphics

C. High Jump Landing Pad: Sportsfield Specialties or equal.
1. HJ168DZ - DuraZone Challenger High Jump Landing Pad
   a. Dimensions: 16'-6" x 8' x 26", NFHS Compliant

b. Base Sections Fabricated of 18.5 oz. Outdoor Heavy Coated Vinyl Polyester Scrim Exterior that has a High Tear and Tensile Strength and Inner Layered " Honeycomb" Polyurethane Foam Core
   1) Heat Welded Vinyl Seams
c. 2" Thick Skirted Top Pad:
   1) 2" Polyurethane Foam Encased in Heavy Duty Vinyl Coated Polyester Mesh that is UV and Spike Resistant, Various Standard Colors Available
   2) 18.5 oz. Outdoor Heavy Coated Vinyl Perimeter Skirt Double Stitched Using 6 lb. Bonded Polyester Black Thread
   3) Unique Skirted Design Prevents the Separation of Base Sections During Use
d. Integral Drainage Layer and Platform:
e. 2" Closed-Cell Nonabsorbent Polypropylene Foam Drainage Grid
   1) Lifts Open-Cell Polyurethane Foam Core 2" Above Finish Grade and Prevents the Absorption of Ground Water
   2) Reduces Waterlogging and Rotting of Inner Foam Core Thereby Increasing Useful Life
   3) Integral Design Does Not Require Manual Set-up nor Offseason Storage
f. Adjustable Nylon Straps with Buckles and 8” Hook and Loop Attachment Securely Connects Base Sections at the Seams
g. 2" Wide Nylon Web Handles for Transport Purposes
h. Stainless Steel Snap Hooks, Buckles and “D” Rings
i. Ten (10) Year Warranty on Seams, Handles and Hardware Attachments

2. HJ168AWC - All Weather Cover
   a. Form-Fitting Size and Shape
   b. 18.5 oz. Outdoor Heavy Coated Vinyl Polyester Scrim, Various Standard Colors Available
   c. Heat Welded Seams
3. HJDG - Custom Digitally Printed Lettering and/or Graphics

D. Long Jump and Triple Jump System: Sportsfield Specialties or equal.
   1. 12" and 8" Long and Triple Jump Take-Off Board System:
      a. White Synthetic Polyboard with Textured Surface
         1) Dimensions: 8" x 48" x 3/4" (0.75")
         2) Grooved Edges for Slide-on Assembly, No Exposed Fastening Hardware
         3) Plasticene Included
      b. Yellow Synthetic Polyboard Foul Strip
         1) Dimensions: 4" x 48" x 3/4" (0.75")
         2) Grooved Edges for Slide-on Assembly, No Exposed Fastening Hardware
      c. Extruded Aluminum Insert/Spacer
         1) 1/8” (0.125") Wall Thickness
         2) Designed to Accommodate Slide-on Take-Off Board and Foul Strip Assembly
         3) Includes Leveling Bolts
      d. Formed Aluminum Blanking Lid
         1) 1/8" (0.125") Aluminum Sheet

2) 1/2" (0.5") Recess to Accept Synthetic Track Surfacing by Others
3) Includes Leveling Bolts

e. 16 Gauge (0.60”) 304 Stainless Steel Tray
1) Includes 1" PVC Drain Stub (Oriented at Either End) to Ensure Positive Connection to Subsurface Drainage System by Others

E. Pole Vault Box Cover: Sportsfield Specialties or equal
1. PVBCPSS - Stainless Steel Pole Vault Box Cover Plug:
a. Constructed with Formed 0.090" Aluminum
b. Size and Shape Designed to Fill Pole Vault Box Void Space
c. 1/2" (0.5") Recess to Accept Synthetic Track Surfacing by Others
d. Includes Retractable Pull Handle
e. Specifically Conducive with Model PVBSS Stainless Steel Pole Vault Box

F. Pole Vault Box: Sportsfield Specialties or equal
1. PVBSS - Stainless Steel Pole Vault Box:
a. 13 Gauge Stainless Steel Construction
b. Mill Finish
c. 30° Reverse Bend at Pole Vault Box Entryway
d. 7.874" (0.2m) Long
e. Concrete Set Wings to Reduce Floating During Installation
f. Meets or Exceeds NFHS, NCAA, and IAAF Rules and Regulations for Size and Shape

G. Pole Vault System: Sportsfield Specialties or equal.
1. PVS0517 5'-17' Pole Vault Standards Set.
a. (2) Steel Base Assemblies: Each Fabricated of (2) 7-Gauge Steel Sheet Bent Channels Welded to (3) 1/4” x 1” Steel Flat Bar Supports, (2) of Which Contain Mounting Points
1) Allows for up to 32” of Upright Motion Away from the Zero Line of a Pole Vault Box
2) Compatible with PVSFS Pole Vault Standard Forming System (Sold Separately)
b. (2) Rolling Base Assemblies: Each Fabricated of (1) 7-Gauge Steel Sheet Base with (8) Wheels, (4) of Which are Adjustable for Tensioning
c. (2) Mounting Stubs: Each Fabricated of 7-Gauge Steel Sheet
a. Mounts Uprights to Rolling Base Assemblies
d. (2) Uprights: Each Fabricated of a Custom Aluminum Extrusion
1) Height: 105.50”
e. (2) Riser Assemblies: Each Fabricated of (1) 1.50” Square Aluminum Tube with 3/8” x ¾” Aluminum Mounting Block Welded Near the Bottom
1) Travels Inside of Uprights to Raise and Lower Pins
f. (2) Extension Arm Assemblies, (1) Left and (1) Right: Each Fabricated of (1) 1.50” Square Aluminum Tube Pin Mount and (1) 1/8” Aluminum Sheet Extension with SSI Logo
1) Left and Right Extension Arms will be Labeled as such
g. (12) 55mm Rest Pins and (12) 75mm Rest Pins: Fabricated of ½” Aluminum Round Stock
1) 55mm Pins are used for High School Competition and 75mm Pins are used for NCAA competition, both Size Pins are Included

h. Super Durable Powder Coated Finish: Black, Red and Silver Standard
i. Installation Package Consisting of the Following Components:
1) Hardware Kit
2) Installation Instructions

H. Pole Vault Forming System: Sportsfield Specialties or equal
1. PVSFS Pole Vault Standard Forming System.
a. (2) PVSFS Forms; 1 for each side of pit: Fabricated from 1/8" Aluminum Sheet, with 1" Aluminum Round Stock Tapping Blocks welded in each quadrant for mounting.
1) Compatible with PVS517 Pole Vault Standards (Sold Separately).
b. (4) Removable Side Walls; 2 for each Form: Fabricated from 1/8" Aluminum Sheet.
1) Allow for concrete flow as required by job by removing or leaving Side Walls in place.
c. Installation Package consisting of the following components:
1) Hardware kit (mounting bolts and washers)
2) Installation instructions

I. Pole Vault Landing Pad: Sportsfield Specialties or equal.
1. PV2224HDZ - DuraZone National Pole Vault Landing Pad.
a. Dimensions: 21'-6" x 24' x 32", NFHS and NCAA Compliant
b. Base Sections Fabricated of 18.5 oz. Outdoor Heavy Coated Vinyl Polyester Scrim Exterior that has a High Tear and Tensile Strength and Inner Layered "Honeycomb" Polyurethane Foam Core
1) Heat Welded Vinyl Seams
c. 2" Thick Skirted Top Pad:
1) 2" Polyurethane Foam Encased in Heavy Duty Vinyl Coated Polyester Mesh that is UV and Spike Resistant, Various Standard Colors Available
2) 18.5 oz. Outdoor Heavy Coated Vinyl Perimeter Skirt Double Stitched Using 6 lb. Bonded Polyester Black Thread
3) Unique Skirted Design Prevents the Separation of Base Sections During Use
d. Integral Drainage Layer and Platform:
1) 2" Closed-Cell Nonabsorbent Polypropylene Foam Drainage Grid
2) Lifts Open-Cell Polyurethane Foam Core 2" Above Finish Grade and Prevents the Absorption of Ground Water
3) Reduces Waterlogging and Rotting of Inner Foam Core Thereby Increasing Useful Life
4) Integral Design Does Not Require Manual Set-up nor Offseason Storage
e. Removable 8' x 10' White Mesh Coach's Preferred Landing Area, Secured with Hook and Loop
f. Adjustable Nylon Straps with Buckles and 8" Hook and Loop Attachment Securely Connects Base Sections at the Seams
g. 2" Wide Nylon Web Handles for Transport Purposes
h. Stainless Steel Snap Hooks, Buckles and "D" Rings
i. Ten (10) Year Warranty on Seams, Handles and Hardware Attachments
j. Includes PVPBSC - Pole Vault Planting Box Safety Collar:

1) 4” High Density Foam
2) 18.5 oz. Outdoor Heavy Coated Vinyl Polyester Scrim Exterior Encasement
3) Color: Yellow
4) NFHS and NCAA Compliant
5) Meets or Exceeds ASTM F2949-12 Standards

k. PV2224HAWC - All Weather Cover
1) Form-Fitting Size and Shape
2) 18.5 oz. Outdoor Heavy Coated Vinyl Polyester Scrim, Various Standard Colors Available
3) Heat Welded Seams

l. PVDG - Custom Digitally Printed Lettering and/or Graphics

m. Optional:
1) PVBPANG - Pole Vault Standard Base Protector Pads
a) Center Slot Designed for Centered Pole Vault Uprights
b) 72"L x 30"W x 30”H to 16"H (Tapered)
c) Adjustable Measurement Scale with Hook and Loop Attachment
d) 18.5 oz. Outdoor Heavy Coated Vinyl Polyester Scrim Exterior Encasement
e) Polyurethane Foam Core
2) PVBPANGN - Pole Vault Standard Base Protector Pads
a) Notched Opening for Offset Pole Vault Uprights
b) 72"L x 30"W x 28”H to 14"H (Tapered)
c) Adjustable Measurement Scale with Hook and Loop Attachment
d) 18.5 oz. Outdoor Heavy Coated Vinyl Polyester Scrim Exterior Encasement
e) Polyurethane Foam Core

J. Shot Put System: Sportsfield Specialties or equal.
1. TFSP - Shot Put and Hammer ThrowForm® System:
a. 10’ x 10’ x 6” Aluminum Two (2) Piece Forming Assembly
a) Formed 3/16” (0.1875”) Aluminum Frame and Cross Bracing
b) 3/16” (0.1875”) Aluminum Staking Gussets
c) Rebar Notches
2) Bolt Together Construction
b. Throw Ring:
1) Rolled 4” x 1/4" (0.25”) Aluminum Flat Bar
2) Inside Diameter: 84”
3) ¾” (0.75”) Recessed Conrete Finishing Screed Line
4) Integrally Welded to Forming Assembly
2. Ten (10) 1/2" (0.50”) Diameter Aluminum Drainage Pipes Welded Flush with Recessed Concrete Pad
3. Removable Toe Board Mounting Provisions
4. Assembly Hardware

K. Shot Put Toe Board: Sportsfield Specialties or equal.
1. SPTBCARHS - High School Shot Put Toe Board Recessed Pad:

a. 3-1/4”H (4” Above Recessed Concrete Pad) x 4-1/2”W x NFHS Compliant Length and Shape
b. Cast Aluminum Construction
c. Super Durable White Powder Coated Finish
d. Black Viny Sector Lines
e. Includes 3/8”-16 x 2”L Hex Head Bolt, Flat Washer, Lock Washer, and Two-Way Expansion Anchor Hardware

L. Discuss Throw System: Sportsfield Specialties or equal.
1. TFD - Discus ThrowForm® System:
a. 10’ x 10’ x 6” Aluminum Two (2) Piece Forming Assembly
1) Formed 3/16” (0.1875”) Aluminum Frame and Cross Bracing
a) 3/16” (0.1875”) Aluminum Staking Gussets
b) Rebar Notches
2) Bolt Together Construction
b. Throw Ring:
1) Rolled 4” x 1/4" (0.25”) Aluminum Flat Bar
2) Inside Diameter: 98-1/2”
3) 3/4" (0.75”) Recessed Conrete Finishing Screed Line
4) Integrally Welded to Forming Assembly
c. Ten (10) 1/2" (0.50”) Diameter Aluminum Drainage Pipes Welded Flush with Repressed Concrete Pad
d. Assembly Hardware

M. Sandpit with Sandcovers: Sportsfield Specialties or equal.
1. SPSCHS - High School Sand Pit with Sand Catchers:
a. Base Forms Fabricated of 1/8” (0.125”) Thick Aluminum, 150mm (6”) Wide x 2m (6.56’) Long x 395mm (15.6”) High
b. Pre-Fabricated Ninety Degree (90°) Corner Base Forms Fabricated of 1/8” (0.125”) Thick Aluminum, 150mm (6”) Wide x 1.72m (5.66’) Long x 395mm (15.6”) High
c. Bolt Together Aluminum Gusset Reinforced Construction
d. Male and Female Keyed Features
e. Sand Catcher Units Fabricated of 1/8” (0.125”) Thick Aluminum and Have a Forty-Five Degree (45°) Angled Inside Cover Ledge
f. Pre-Fabricated Ninety Degree (90°) Corner Sand Catcher Units Fabricated of 1/8” (0.125”) Thick Aluminum and Have a Forty-Five Degree (45°) Angled Inside Cover Ledge
g. Sand Catcher Units Measure 305mm (12”) Deep x 500mm (19.6”) Wide and Include Four (4) Integral Drainage Tubes, Aluminum Mesh Grate Mat Supports and Perforated ½” (0.5”) Thick Black Rubber Mats
h. 2m (6.56’) Long Runway Insert
i. 3m (9.84’) x 7.14m (23.43’) High School Layout
2. SPCVRHS - Aluminum Cover Set:
a. Welded 1/8” (0.125”) Thick Aluminum Panel Cover Set with Recessed Stainless Steel Lift Handles and ½” (0.5”) Recess to Accept Synthetic Track Material by Others
b. Forty-Five Degree (45°) Angled Ends Conducive with Sand Pit Cover Ledge

N. Discuss Cage: Sportsfield Specialties or equal.
   1. DCHSEA - High School Discus Cage with Extension Arms:
      a. Upright Poles:
      b. 4” Aluminum (4” O.D. x 0.125” Wall) Tube
      c. 36” Rolled Offset
      d. Height: 14’-3 3/8” Above Finish Grade
      e. Alignment Notch
   2. Net Stablizing Extension Arms:
      a. 3/8” x 4” x 36” Steel Flat Bar
      b. Includes Hinge and U-Bolt Attachment
   3. Super Durable Black Powder Coated Finish
      a. Enhanced Resistance to UV
   4. Ground Sleeve:
      a. 30” Depth
      b. Aluminum Construction
      c. Welded Leveling Plate
      d. Alignment Bolt
      e. Press Fit Ground Sleeve Plug
   5. Main Net:
      a. #36 Black Nylon Net, 1-3/4” Square Mesh with Sewn Rope Bound Perimeter
      b. 13’H x 54’L
   6. Retractable Pulley System:
      a. Includes Swivel Pulleys, Tethers, and Rope Cleats
   7. Optional:
      a. DCHSBNS - High School Discus Cage Backup Net System:
      b. #36 Black Nylon Net, 1-3/4” Square Mesh with Sewn Rope Bound Perimeter
      c. 7’H x 63’L
      d. Includes Assembly Hardware

O. Shot Put Cage: Sportsfield Specialties or equal.
   1. SPCEA - Shot Put Cage with Extension Arms:
      a. Upright Poles:
         1) 4” Aluminum (4” O.D. x 0.125” Wall) Tube
         2) 36” Rolled Offset
         3) Height: 14’-3 3/8” Above Finish Grade
         4) Alignment Notch
      b. Net Stablizing Extension Arms:
         1) 3/8” x 4” x 36” Steel Flat Bar
         2) Includes Hinge and U-Bolt Attachment
         3) Super Durable Black Powder Coated Finish
         4) Enhanced Resistance to UV
      c. Ground Sleeve:
         1) 30” Depth
         2) Aluminum Construction
         3) Welded Leveling Plate
         4) Alignment Bolt
         5) Press Fit Ground Sleeve Plug
      d. Main Net:

1) #36 Black Nylon Net, 1-3/4” Square Mesh with Sewn Rope Bound Perimeter
2) 13’H x 43’L

e. Retractable Pulley System:
1) Includes Swivel Pulleys, Tethers, and Rope Cleats

f. Optional:
1) SPCBNS - Shot Put Cage Backup Net System:
2) #36 Black Nylon Net, 1-3/4” Square Mesh with Sewn Rope Bound Perimeter
3) 7’H x 53’L
4) Includes Assembly Hardware

P. Track Curb: Sportsfield Specialties or equal.
1. TCBA - Anodized Aluminum Track Curb:
a. Dimensions: 2”H x 2”W x 20’ Sections
b. Constructed with Extruded 6063 Aluminum
c. Silver Anodized Finish (Gold Anodization Available Upon Request)
d. Domed Shape with Ribbed Slip Resistant Upper Surface
e. Male and Female Interlocking Design
f. Custom Manufactured per Track Striping Layout
g. Support Feet Create ½” (0.5”) Clearance Above Finish Grade to Permit Surface Drainage
h. Meets or Exceeds NCAA and IAAF Rules and Requirements
i. IAAF Certified

END OF SECTION

SECTION 11 68 43

SCOREBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Single-sided LED scoreboard.
   1. Exterior Application.

B. Related Sections:
   1. Section 09 90 00 Painting
   2. Division 26 Electrical

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. Standard for Electric Signs, UL-48, 14th Edition.

C. Standard for Control Centers for Changing Message Type Signs, UL-1433, 4th Edition.

D. Federal Communications Commission Regulation Part 15.

E. California Electric Code, 2019.

F. Standard for CAN/CSA 22.2 No. 207-M89.

1.03 SUBMITTALS

A. Product data: Submit manufacturer’s product illustrations, data and literature that fully describe the scoreboards and accessories proposed for installation.

B. Shop drawings: Submit mechanical and electrical drawings.

C. Shop drawings and structural calculations (signed and stamped by the manufacturer's licensed California structural engineer without extra cost to Owner) for architectural/engineering review, approval and submittal to the Division of the State Architect.

D. Maintenance data: Submit manufacturer’s installation, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

A. For outdoor use.

B. Source Limitations: Obtain each type of scoring or related equipment through one source from a single manufacturer.

C. ETL listed to UL Standards 48 and 1433.

D. NEC compliant.

E. FCC compliant.

F. ETLC listed to CAN/CSA 22.2.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Product delivered on site.

B. Scoreboard and equipment to be housed in a clean, dry environment.

1.06 PROJECT CONDITIONS

A. Environmental limitations: Do not install scoreboard equipment until mounting structure is secure and concrete has ample time to cure.

B. Field measurements: Verify position and elevation of structure and its layout for scoreboard equipment. Verify dimensions by field measurements.

C. Verify mounting structure is capable of supporting the scoreboard's weight and windload in addition to the auxiliary equipment.

1.07 WARRANTY/SERVICE PLAN

A. Provide 5 years of coverage.

B. Provide an exchange program to supply replacement parts for components that fail during the coverage period. To minimize downtime, the exchange parts will be shipped on the same day the order is received or on the following day. The manufacturer will also enclose an air bill for return of the defective components.

C. Provide access to a local Authorized Service Company.

D. Provide a help desk staffed by experience technicians and coordinators who are thoroughly familiar with the scoreboard and available for technical support. This staff must be available at no additional cost to the customer and provide an "on-call" service during weekends.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of the following manufacturers form the basis for design and quality intended.
   1. Daktronics, Inc., Brookings, South Dakota.

2. NEVCO Scoreboard Company, Greenville IL.
3. TRANS-LUX/FairPlay, Des Moines, IA.
4. ALL AMERICAN SCOREBOARDS, Pardeeville, WI.
5. Sportable Scoreboards, Murray, KY.
6. Electro-Mech Scoreboard Co., Wrightsville, GA.

B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

2.02 PRODUCTS, EXTERIOR

A. Timing Display
1. Daktronics TI-2021 portable seven-digit LED timing display and field event board shows competitor/attempt numbers, imperial performance and metric performance. In addition, switches on the side of the display allow selection of ten programmable functions and adjustment of timer settings. Provide all components for a single ended timing system and a ten-line scoreboard.
2. Display
   a. General Information
      1) Dimensions: 1'-6" (457 mm) high, 5'-6" (1.63 m) wide, 0'-6" (152 mm) deep
      2) Weight: 60 lb (27 kg)
      3) Power requirement: 115 W
      4) Color: semi-gloss black
   b. Construction
      1) Alcoa aluminum alloy 5052 for excellent corrosion resistance
      2) Display back, face, and perimeter: 0.063" (1.60 mm) thick
   c. Digits
      1) LED color – Red
      2) All digits: 10" (254 mm) high
      3) Seven bar segments per digit
      4) PanaView® LED digit technology
      5) All digits and indicators are sealed front and back with weather-tight silicone gel
   d. Captions
      1) White vinyl applied directly to display face
      2) All captions: 3" (76 mm) high
   e. Accessory Equipment
      1) Tripod and mounting bracket
      2) Horn
3. Scoring Console
   a. Console is an All Sport 1600 controller
   b. Scores multiple sports using changeable keyboard inserts

c. Controls multiple scoreboards and displays, including other All Sport 1600 controlled displays currently owned by customer
d. Recalls clock, score, and period information if power is lost
e. Runs Time of Day and Segment Timer modes
f. Console includes:
   1) Rugged aluminum enclosure to house electronics
   2) Sealed membrane water-resistant keyboard
   3) 32-character LCD to verify entries and recall information currently displayed
   4) Power cord that plugs into a standard grounded outlet; 3 watts max
   5) Control cable to connect to the control receptacle junction box (wired system only)
   6) Soft-sided carrying case
g. Accessory Equipment
   1) 2.4 GHz spread spectrum radio system with frequency hopping technology and 64 non-interfering channels; system includes a transmitter installed inside the console and a receiver installed inside the display(s)
   2) Hard carrying case
   3) Battery pack]

B. LED Matrix Display
1. LVX-2160-132x242-16MT-MR-LT-25, 7.2’ x 9.4’ Ad Panels: LVX displays show live and recorded video clips, real-time scores/stats, animations, graphics, and text messages. Modules feature 3 through-hole LEDs per pixel (1 red, 1 green, 1 blue) with 16 mm row and column spacing
   a. General Information
      1) Cabinet Dimensions: 7.2' (2.19 m) high, 25' (7.62 m) wide, 11.0625" (281 mm) deep
      2) Matrix size: 132 lines by 242 columns
      3) Line Spacing 16mm
      4) Weight: Unpackaged 1515 lbs per display
      5) Max Power 4195 watts/display
      6) Ad panels: 7.2’ x 9.4’
   b. Cabinet Paint Color
      1) Standard: Semi-gloss black on sides only
   c. Construction
      1) All-aluminum construction for light weight and corrosion resistance
      2) Service Access: Front or Rear
   d. Display Capabilities
      1) Color Capacity: 16 bit (281 trillion colors)
      2) LED Refresh Rate: 4800 Hz as defined by the number of times per second the LED image is repainted in intensity
      3) Display has signal redundancy allowing for signal path both forward and backwards through modules allowing for loss of only 1 module vs. rows or blocks of multiple modules or panels in case of failure.
   e. Viewing Characteristics
      1) Module Intensity: 9500 nits (adjustable)
      2) Brightness Control: 256 levels (manual, scheduled or automatic)
      3) Suggested Viewing Angle: 160° horizontal and +25°/-45° vertical

f. Pixel Characteristics
   1) Each pixel consists of 3 through-hole LEDs per pixel (1 red, 1 green, 1 blue).
      a. Pixels with an overbalance of one color (e.g. 2 red, 1 green, 1 blue) are not acceptable.
   2) Pixel spacing measurement must be measured from the center points of neighboring physical pixels, rather than neighboring physical and virtual pixels.

g. LED Module Characteristics
   1) Module shall be for outdoor use.
   2) Module shall have anti-reflective paint or coating applied to display face. Black state across all modules shall exhibit a Delta E color variation of no more than .4.
   3) Modules shall have horizontal louvers running between LEDs or pixels.
   4) Modules shall be able to be removed and installed from both the front and rear of the display.
   5) It is not necessary to remove or insert screws in order to remove or install modules.
   6) Module shall be silicon potted on face beneath louver and rear, providing a 100% waterproof seal, regardless of module, cabinet or panel construction.

h. Video Processing
   1) Video Frame Rate: 50/60 frames per second
   2) Graphic Frame Rate: 30 frames per second
   3) Processing Architecture: 22-bit distributed
   4) System Architecture: 100% digital
   5) Video Enhancement: Color space conversion, adjustable gamma correction, proprietary sharpening technology and enhancement algorithms for optimal picture quality

i. LED Quality
   1) Quality Control: Sorted by intensity and color wavelength
   2) LED Lifetime: 100,000 hours of operation as defined by time at which display intensity has decreased to 50 percent of the original intensity

j. Calibration
   1) Pixel-to-pixel and module-to-module optical color calibration must be performed at the factory. The manufacturer must also provide easy-to-use calibration software that allows individual modules and pixels to be independently adjusted while in the display.
   2) If modules should need replacement during the life of the display, the calibration software must match newer modules' brightness levels to older modules' levels to preserve picture quality and maintain a uniform display appearance.

k. Display Interface
   1) The full-color video display must be able to interface and display real-time data from the control system without the need for a duplicate or redundant input.

2. Accessory Equipment:
   a. Standard Definition or High Definition (1080p); video input: Control-1 video input (Primary Player and Processor Only) with Laptop
   b. Scoring Console: All Sport 5010 Control Console Kit – AS-5010
   c. Displays Game0In-Progress Information – Standard Video All Sport RTD Input Kit
   d. Fiber Optic Cable, 50 μm Multimode; 6 Fiber with non-terminated ends – W-1489
      1) Cabinet Dimensions: 1-0” H x 1’-0” W x 1’-0” D
      2) Weight: Packaged 308 lbs per display
   e. Stand-Alone Trumpet Horn for use with Outdoor Displays – Stand-Alone 120 VAC Trumpet Horn
   f. Ad Panel, Above – Outdoor Non-Backlit 3’-0” x 32’-0” Horizontal
      1) Cabinet Dimension: 3’-0” H x 32’-0” W x 0’-8” D
      2) Weight: Packaged 240 lbs per display

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that mounting structure is ready to receive scoreboard. Verify that placement of conduit and junction boxes are as specified and indicated in plans and shop drawings. Verify concrete has cured adequately according to specifications.

3.02 INSTALLATION

A. All power and control cables to scoreboards and displays will be routed in conduit, power to the scoreboards/displays as well as raceways shown on electrical plans by the Electrical Contractor. Scoreboard control wiring including will be the responsibility of the contractor assigned the scoreboard equipment.

B. Install scoreboards and exterior displays to beams in location detailed and in accordance with manufacturer's instructions. Verify unit is plumb and level.

C. Follow manufacturer's current application requirements for installation under conditions specific to the project.

D. Install all structural steel components in accordance with manufacturers application instructions where specified on the drawings.

E. All structural steel components shall be in accordance with ASTM A36 or A572.
   1. All Tube ends shall be covered with light gauge end caps.
   2. All new steel shall be primed and painted with a color approved by the architect
   3. Weld steel using E70XX electrodes. Prime and paint all welds following installation. Bolt connections were indicated.
   4. Unless otherwise specified in the drawings, all welds shall be continuous 1/4" (6mm) fillet welds.
   5. Install all electrical equipment in accordance with all federal, state and local building codes.

6. Where manufacturer's requirements and building codes are in direct conflict, the more restrictive method of application shall prevail.

3.03 INSTALLATION – CONTROL CENTER

A. Provide boxes; cover plates and jacks in locations per plans. Control cables to control panels shall be concealed.

B. Test connect control unit to all jacks and check for proper operation of control unit, scoreboard and all features. Leave control unit in carrying case and other loose accessories with Owner's designated representative.

C. Verify earth ground does not exceed 15 ohms.

3.04 INSTRUCTIONS TO OWNER'S PERSONNEL

A. Instruct Owner’s personnel in proper operation and maintenance of all systems, equipment and similar items which were provided as part of Work.

B. Contractor shall provide schedule to Owner for approval for each of instruction periods required. Total hours of training, not less than 1 hour for each individual equipment specified or scheduled.

C. Instruction sessions will be held in Owner designated area on project site and at Owner’s convenience.

D. Instructors shall be qualified by product manufacturer in subject matter presented at training session.

3.05 FINISHES

A. Paint Structural supports per Section 09 90 00. Colors as selected by Architect.

END OF SECTION

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SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Site furnishings and improvement items applicable to Work and not specified under individual technical sections.

1.02 SUBMITTALS

A. Shop drawings and product data for components, hardware and accessories. Show construction and fabrications details, procedures, layout and erection diagrams, anchorages and pertinent information for specified specialty item.

B. Samples sufficiently sized to illustrate clearly all sizes, available colors, materials, patterns and finishes.

C. Manufacturer's installation instructions and maintenance recommendations.

1.03 FIELD MEASUREMENTS

A. Verify site conditions. Obtain accurate dimensions of openings, levels, locations and arrangements of embedded and concealed anchorages. Report discrepancies between drawings and field dimensions to Architect before commencing work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Custom Pre-Cast Concrete Benches with integrated skateboard deterrents and integrated lighting as fabricated by Univeral Precast Concrete, Inc., Upland, CA. Sizes and locations, refer to Drawings. Provide smooth seat and sides.

B. Drinking Fountains:
   1. Manufacturer: Oasis International, Columbia, OH, or approved equal.
   2. Model: Contactless Bi-Level VersaCooler II with Contactless Versafiller, PGEBFSLTT, non-refrigerated.
   3. Finish: As selected by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Complete field assembly of site furnishings, where required. Connect to plumbing systems for complete and operational installation.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored or positioned at locations indicated on Drawings.

3.03 CLEANING

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component

END OF SECTION

SECTION 26 01 20

OPERATION AND MAINTENANCE OF LOW-VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Retain or delete this article in all Sections of Project Manual.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Related Sections include the following:
   1. Division 26, Section 260519, “Low Voltage Electrical Power Conductors and Cables”.
   2. Division 26, Section 260526, “Grounding and Bonding for Electrical Systems”.
   3. Division 26, Section 260543, “Underground Ducts and Raceways for Electrical Systems”.
   4. Division 26, Section 260548, “Vibration and Seismic Controls for Electrical Systems”.
   5. Division 26, Section 260553, “Identification for Electrical Systems”.
   6. Division 26, Section 262200, “Low Voltage Transformers”.
   7. Division 26, Section 262413, “Switchboards”.
   8. Division 26, Section 262416, “Panelboards”.

1.2 SUMMARY

A. Acceptance and start-up testing requirements for electrical power distribution equipment and systems. Acceptance and start-up tests shall be performed in accordance with requirements of specification sections detailed in item 1.1, B.

B. Preventive maintenance on low voltage electrical system components shall be performed by qualified and experienced electricians and technicians, trained and certified for work on low voltage electrical systems, and in accordance with manufacturer’s instructions.

1.3 CODES, STANDARD, AND REFERENCES

A. All inspections and tests shall be in accordance with the following codes and standards except as provided otherwise herein.
   1. American Society for Testing and Materials – ASTM.
   2. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).
   3. ANSI/NFPA 70E: Standard for Electrical Safety in the Workplace.
   4. ANSI/NFPA 78: Lightning Protection Code.
   5. ANSI/NFPA 101: Life Safety Code.
   6. ANSI/IEEE C2: National Electrical Safety Code (NESC).
   7. Institute of Electrical and Electronic Engineers – IEEE.

8. International Electrical Testing Association - NETA Accept: The NETA Acceptance Testing Specifications, latest edition.
9. Applicable State and Local Codes, Ordinances and Standards, including City of Corona, Southern California Edison (SCE) and El Monte Union High School.
10. California Code of Regulations (CCR), Title 8, Title 24.
11. Division 1, Section 019113, “General Commissioning Requirements”.
12. Insulated Cable Engineers Association – ICEA.
13. National Electrical Manufacturers Association – NEMA.
14. Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

B. All maintenance procedures, inspections and tests shall utilize the following references:
1. Contract Documents.
2. Project list of equipment to be inspected and tested.
3. Manufacturer’s instruction manuals applicable to respective equipment.

1.4 SUBMITTALS

A. Provide submittals per Division 1, Section 013300, “Submittal Procedures”.

B. Qualifications of maintenance servicing contractor and personnel.

C. Maintenance Log and Certified test reports.

D. Four copies of blank forms for checklists, test reports, and other related forms for Project Manager’s review and approval.

1.5 QUALIFICATIONS OF CONTRACTOR AND TESTING FIRM

A. The Electrical Contractor performing scheduled and/or non-scheduled service and maintenance on low voltage electrical distribution equipment shall be in possession of a California State Electrical License and any Certification necessary to perform the specified Scope of Work.

B. The Contractor shall retain and pay for the services of a recognized, independent testing firm for the purpose of performing inspections and tests as herein specified and as required by code.

C. The testing firm shall be an independent testing organization with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

D. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems, with at least five (5) years of documented experience.

E. The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.

F. The lead, on-site, technical person shall be currently certified by the InterNational Electrical Association (NETA) or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

G. The testing firm shall submit proof of the above qualifications with bid documents when requested.

1.6 GENERAL REQUIREMENTS

A. Routine insulation resistance, continuity, and rotation tests for all distribution and utilization equipment shall be performed prior to and in addition to scheduled and/or unscheduled maintenance servicing, and acceptance tests, as specified herein.

B. The Testing Firm shall notify the Project Manager no fewer than 3 working days prior to commencement of any testing.

C. Any system, material, or workmanship, which is found defective on the basis of Acceptance Tests, during performance of maintenance, shall be reported to the Project Manager, with recommendations for corrective action.

D. The Testing Firm shall maintain a written record of all tests, and upon completion of project, shall assemble and certify a final test report.

E. The final Test Report, original and four copies, shall be submitted on conclusion of all required tests and corrective measures.

F. The following equipment shall be serviced, tested, and calibrated:
1. Low Voltage Switchgear.
2. Low Voltage Transformers: Unit Substation Type, and separate units, Dry Type.
3. Distribution Switchboards.
4. Circuit Breakers: Air, Molded Case, 100A frame and larger.
5. Protective Relays, instruments, and metering systems.
6. Grounding Systems and ground fault protection systems.

1.7 SAFETY AND PRECAUTIONS

A. All service and maintenance procedures and related tests shall be performed with equipment de-energized. Exceptions shall be thoroughly reviewed to identify safety hazards, and adequate safeguards shall be devised.

B. Safety practices shall include, but will not be limited to, compliance with the following requirements:
1. Occupational Safety and Health Act.
2. Accident Prevention Manual for Industrial Operations, National Safety Council.
3. Applicable State and Local safety operating procedures.
4. Owners' Safety Practices.
5. National Fire Protection Association – NFPA 70E.
6. American National Standards for Personnel Protection.

C. The Testing Firm shall have a designated safety representative on the project site to supervise the testing operations with respect to safety.

D. Test Report:
   1. The test report shall include the following:
      a. Summary of Project.
      b. List of testing equipment used.
      c. Calibration date of testing equipment and due date of next calibration.
      d. Ambient temperature and humidity at time of test.
      e. Listing of equipment tested.
      f. Test results.
      g. Recommendations.
      h. Furnish original and four copies of the complete maintenance log and test report to the Project Manager in accordance with requirements of Contract Documents.

1.8 INSPECTION AND TEST PROCEDURES

A. Contractor shall provide the Testing Firm, a copy of related contract documents such as drawings, specifications, engineer-reviewed submittals, coordination study report including all relay settings and other necessary information.

B. Contractor shall supply a suitable source of power to each site and location per testing firm requirements.

C. Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

D. Testing Firm shall review and evaluate all received documents and notify the Contractor and Project Manager of any discrepancies in the documents, and/or any other requirements immediately.

E. Testing Firm shall provide and comply with the following:
   1. Acceptance test procedures for each individual equipment listed in Part 1 of this section for Engineer review and approval prior to any test and after thorough evaluation of the system. Testing shall conform to the InterNational Electrical Testing Association (NETA) specifications and standards for electrical power distribution equipment and systems and manufacturer's instructions.
   2. Refer to each individual specification section for testing requirements and comply.
   3. Inspect installed and/or serviced equipment and report any discrepancy and/or deficiency with respect to the contract documents and governing codes prior to testing.

PART 2 - PRODUCTS

A. Not Applicable

PART 3 - EXECUTION

3.1 SYSTEM FUNCTION TEST

A. Perform system function test upon completion of service and maintenance procedures and related equipment tests as defined in this section. It is the purpose of system function tests to verify proper interaction of all sensing, processing, and action devices.

B. Implementation:
   1. Develop test parameters for the purpose of evaluation performance of all integral components and their functioning as a complete unit within design requirements.
   2. Test all interlocking devices.
   3. Record the operation of alarms and indicating devices.

3.2 DEFICIENCIES

A. All deficiencies reported by the Testing Firm shall be corrected by the Contractor and Acceptance and System Function Tests shall be repeated to verify conformance with requirements.

END OF SECTION

SECTION 26 01 50

OPERATION AND MAINTENANCE OF LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related sections include the following:
   1. Division 26, Section 260120, “Operation and Maintenance of Low Voltage Electrical Distribution”.
   2. Division 26, Section 260519, “Low Voltage Electrical Power Conductors and Cables”.
   3. Division 26, Section 260526, “Grounding and Bonding for Electrical Systems”.
   4. Division 26, Section 260548, “Vibration and Seismic Controls for Electrical Systems”.
   5. Division 26, Section 260553, “Identification for Electrical Systems”.
   6. Division 26, Section 260923, “Lighting Control Devices”.
   7. Division 26, Section 265100, “Interior Lighting”.
   8. Division 26, Section 265600, “Exterior Lighting”.

1.2 SUMMARY

A. Acceptance and start-up testing requirements for lighting equipment and systems. Contractor shall retain and pay for the services of a recognized, independent testing firm for the purpose of performing inspections and tests as herein specified and as required by code.
   1. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
   2. It is the purpose of these tests to assure that all tested electrical equipment is operational and within industry and manufacturers tolerances, and is installed in accordance with design specifications.
   3. The tests and inspections shall determine suitability for start-up and energization.
   4. The following equipment shall be tested and calibrated.
      a. Lighting controls
      b. Low voltage switches, fuses, and circuit breakers.
      c. Low voltage cables and feeders.
      d. Grounding systems and ground fault protection systems.

1.3 CODES, STANDARDS, AND REFERENCES

A. All inspections, tests, and maintenance procedures shall be in accordance with the following codes and standards except as provided otherwise herein.
   1. National Electrical Manufacturers Association – NEMA.
   2. American Society for Testing and Materials – ASTM.

3. Institute of Electrical and Electronic Engineers – IEEE.
4. InterNational Electrical Testing Association – NETA.
5. Acceptance Testing Specifications – ATS latest edition.

B. ANSI/IEEE C2: National Electrical Safety Code (NESC).

C. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

D. ANSI/NFPA 70E: Standard for Electrical Safety in the Workplace.

E. ANSI/NFPA 78: Lightning Protection Code

F. ANSI/NFPA 101: Life Safety Code.

G. Insulated Cable Engineers Association – ICEA.

H. International Electrical Testing Association - NETA ATS: The NETA Acceptance Testing Specifications.

I. Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

J. State and Local Codes and Ordinances.

K. All inspections, tests, and maintenance schedules shall utilize the following references:
1. Project design specifications.
2. Project design drawings.
3. Project list of equipment to be inspected and tested.
4. Manufacturer's instruction manuals applicable to respective equipment.

1.4 QUALIFICATIONS OF TESTING FIRM

A. The testing firm shall be an independent testing organization with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems, with at least five (5) years of documented experience.

C. The lead, on-site, technical person shall be currently certified by the InterNational Electrical Association (NETA), or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

D. The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.

E. The testing firm shall submit proof of the above qualifications with bid documents when requested.

F. The terms used herein, such as Testing Agency, Testing Contractor, Testing Laboratory, or Contractor Test Company, shall be construed to mean the testing firm.

1.5 SUBMITTALS

A. Provide submittals per Division 1, Section 013300, “Submittal Procedures”.

B. Qualifications of testing firm and personnel.

C. Certified test reports.

D. Two copies of blank forms for checklists, test reports, and other related forms for Engineer’s review and approval.

1.6 GENERAL REQUIREMENTS

A. Routine insulation resistance, continuity, and rotation tests for all distribution and utilization equipment shall be performed prior to and in addition to acceptance tests specified herein.

B. The Testing Firm shall notify the Architect no fewer than 3 working days prior to commencement of any testing.

C. Any system, material, or workmanship, which is found defective on the basis of Acceptance Tests shall be reported to the Architect with recommendations for corrective action.

D. The Testing Firm shall maintain a written record of all tests, and upon completion of project, shall assemble and certify a final test report.

E. The final Test Report shall be submitted on conclusion of all required tests and corrective measures.

F. Furnish original and four copies of the complete report to the Architect in accordance with requirements of Contract Documents.

1.7 SAFETY AND PRECAUTIONS

A. Safety practices shall include, but will not be limited to, compliance with the following requirements:
   1. Occupational Safety and Health Act.
   2. Accident Prevention Manual for Industrial Operations, National Safety Council.
   3. Applicable State and Local safety operating procedures.
   4. Owners’ Safety Practices.
   5. National Fire Protection Association – NFPA 70E.
   6. American National Standards for Personnel Protection.

B. All tests shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and adequate safeguards must be devised.

C. The Testing Firm shall have a designated safety representative on the project site to supervise the testing operations with respect to safety.

D. Test Report:
   1. The test report shall include the following:
      a. Summary of Project.
      b. Listing of equipment tested.
      c. Test results.
      d. Recommendations.

E. Furnish original and four copies of the complete report to the Architect in accordance with requirements of Contract Documents.

1.8 INSPECTION AND TEST PROCEDURES

A. Contractor shall provide the Testing Firm, a copy of related contract documents such as drawings, specifications, engineer-reviewed submittals, coordination study report including all relay settings and other necessary information.

B. Contractor shall supply a suitable source of power to each site and location per testing firm requirements.

C. Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

D. Testing Firm shall review and evaluate all received documents and notify the Contractor and Engineer of any discrepancies in the documents and/or any other requirements immediately.

E. Testing Firm shall provide and comply with the following:
   1. Acceptance test procedures for each individual equipment listed in Part 1 of this section for Engineer review and approval prior to any test and after thorough evaluation of the system. Testing shall conform to the interNational Electrical Testing Association (NETA) specifications and standards for electrical power distribution equipment and systems and manufacturer's instructions.
   2. Refer to each individual specification section for testing requirements and comply.
   3. Inspect installed equipment and report any discrepancy and/or deficiency with respect to the contract documents and governing codes prior to testing.

1.9 SYSTEM FUNCTION TEST

A. Perform system function test upon completion of equipment tests as defined in this section. It is the purpose of system function tests to verify proper interaction of all sensing, processing, and action devices.

B. Implementation.

C. Develop test parameters for the purpose of evaluation performance of all integral components and their functioning as a complete unit within design requirements.

D. Test all interlocking devices.

E. Record the operation of alarms and indicating devices.

1.10 DEFICIENCIES

A. All deficiencies reported by the Testing Firm shall be corrected by the Contractor and Acceptance and System Function Tests shall be repeated to verify conformance with requirements.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 01, 07 and 08 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Electrical equipment coordination and installation.
   2. Sleeves for raceways and cables.
   3. Sleeve seals.
   4. Grout.
   5. Common electrical installation requirements.

1.03 CODES, STANDARDS AND REFERENCES

A. American Society for Testing and Materials (ASTM) – ASTM C1107: Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

B. American Society for Testing and Materials (ASTM) – ASTM A53/A53M: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ANSI/NFPA 70 – National Electrical Code (NEC), with California amendments (CEC).

D. International Electrical Testing Association - NETA ATS: The NETA Acceptance Testing Specifications.

E. National Electrical Contractors Association (NECA) - NECA 1: Good Workmanship in Electrical Construction.

F. National Electrical Manufacturers Association (NEMA) –

G. National Electrical Manufacturers Association (NEMA) – NEMA WC26: Bi-national Wire and Cable Packaging Standard.

H. National Electrical Manufacturers Association (NEMA) – NEMA WC70: Non-Shielded Power Cable 2000 V or Less.

I. State and Local Codes and Ordinances.

1.04 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.05 SUBMITTALS

A. Product Data: For sleeve seals.

1.06 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08, Section 083113, "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07, Section 078413, "Penetration Fire-Stopping."

PART 2 - PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM, or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Stainless steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.03 GROUT

A. Non-metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, non-metallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with fire-stop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07, Section 079200, "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with fire-stop materials. Comply with requirements in Division 07, Section 078413, "Penetration Fire-Stopping".

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRE-STOPPING

A. Apply fire-stopping material to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Fire-Stopping materials and installation requirements are specified in Division 07, Section 078413, "Penetration Fire-Stopping."

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 and 07 Specification Sections, apply to this Section.

B. Related Sections include the following:
   1. Division 26 Section 260553, “Identification for Electrical Systems”.
   2. Division 26 Section 262726, “Wiring Devices”.

1.02 SUMMARY

A. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.
   3. Sleeves and sleeve seals for cables.

1.03 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.04 CODES, STANDARDS, AND REFERENCES

A. American Society for Testing and Materials (ASTM) – ASTM A53/A53M: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

B. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

C. California Code of Regulations (CCR) Title 24, Part 6, California Energy Code.

D. National Electrical Contractors Association (NECA) - NECA 1: Good Workmanship in Electrical Construction.

E. National Electrical Manufacturers Association (NEMA) – NEMA WC26: Bi-national Wire and Cable Packaging Standard.

F. National Electrical Manufacturers Association (NEMA) – NEMA WC70: Non-Shielded Power Cable 2000 V or Less.

G. International Electrical Testing Association (NETA) – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

H. Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

I. State and Local Code and Ordinances.

J. Underwriters Laboratories – UL 83 – Thermoplastic Insulated Wires.

K. Underwriters Laboratories – UL 467 – Grounding and Bonding Equipment.

L. Underwriters Laboratories – UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.

1.05 SUBMITTALS

A. Product Data: Provide data for building wire and each cable assembly type. Select each length to complete set of manufacturer's markings. Attach tag indicating cable size and application information. Provide record documents showing actual locations of components and circuits.

B. Qualification Data: For testing agency.

C. Field quality-control test reports: Indicate and interpret test results for compliance with performance requirements.

D. Provide manufacturer's instructions for use of ground megger with proposed method indicated.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Manufacturers: Shall be specialized in manufacturing products specified in this section with minimum ten years (documented) experience.

D. Comply with CEC.

E. Comply with CCR Title 24, Part 6, California Energy Code.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Product Requirements: Products storage and handling requirements.

B. Deliver wires and cables according to NEMA WC 26.

1.08 COORDINATION

A. Division 01, Section 013100, “Project Management and Coordination”: As required for coordination.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

C. Coordinate layout and installation of wiring and cables with other installations.

D. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work, include, but are not limited to, the following:
1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Conductors: Copper. Comply with NEMA WC 70.

C. Conductor Insulation: Types THHN-THWN, XHHW2. Comply with NEMA WC 70.

2.02 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07, Section 078413, "Penetration Fire-Stopping."

2.04 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Advance Products & Systems, Inc.
   2. Calpico, Inc.
   3. Metraflex Co.
   4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
   1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   2. Pressure Plates: Stainless steel. Include two for each sealing element.
   3. Connecting Bolts and Nuts: Stainless steel, of length required, to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Copper: solid for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW2, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

F. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway.

G. Exposed Branch Circuits, Including in Crawl spaces: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway, or Type XHHW2.

J. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway.

K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain-relief device at terminations to suit application.

L. Class 1 Control Circuits: Type THHN-THWN, in raceway.

M. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLE

A. Conceal raceways in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary. Compound used must not deteriorate conductor insulation. Do not exceed manufacturer’s recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support raceways according to Section 260529, "Hangers and Supports for Electrical Systems”.

F. Identify and color-code conductors and cables according to Section 260553, "Identification for Electrical Systems”.

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12-inches of slack.

3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07, Section 078413, "Penetration Fire-Stopping".

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:
   1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
   2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to or greater than, 16 inches , thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with fire-stop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches above finished floor level unless otherwise noted.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07, Section 079200, "Joint Sealants".

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with fire-stop materials according to Division 07, Section 078413, "Penetration Fire-Stopping".

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Above ground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.06 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.07 FIRE-STOPPING

A. Apply fire-stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07, Section 078413, "Penetration Fire-Stopping".

3.08 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:
1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding critical equipment and services, as indicated on drawings, for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
   a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after

remedial action. Furnish original and four copies of the complete report to the Architect in accordance with requirements of Contract Documents

D. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
   4. Furnish original and four copies of the complete report to the Architect in accordance with requirements of Contract Documents

E. Remove and replace malfunctioning cables and retest as specified above.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment**,** plus the following special applications**:**

B. Underground distribution grounding.
   1. Common ground bonding with lightning protection system.

1.03 CODES, STANDARDS AND REFERENCES

A. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

C. ANSI/IEEE C2: National Electrical Safety Code (NESC)

D. American Society for Testing and Materials (ASTM) - ASTM B3: Standard Specification for Soft or Annealed Copper Wire.

E. American Society for Testing and Materials (ASTM) - ASTM B8: Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

F. American Society for Testing and Materials (ASTM) - ASTM B33: Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.

G. EIA/TIA-568-B – Commercial Building Telecommunication Wiring Standard.

H. EIA/TIA-569 – Commercial Building Standard for Telecommunication Pathways.

I. Institute of Electrical and Electronic Engineers (IEEE) - IEEE 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems.

J. Institute of Electrical and Electronic Engineers (IEEE) - IEEE 81: IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

K. National Fire Protection Association (NFPA) - NFPA 70B: Recommended Practice for Electrical Equipment Maintenance.

L. National Fire Protection Association(NFPA) - 780: Standard for the Installation of Lightning Protection Systems.

M. Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

N. Underwriters Laboratories – UL 96: Lightning Protection Components

O. Underwriters Laboratories – UL 83 – Thermoplastic Insulated Wires.

P. Underwriters Laboratories – UL 467 – Grounding and Bonding Equipment.

Q. Underwriters Laboratories – UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.

1.04 DEFINITIONS

A. TMGB: Telecommunications Main Ground Bar.

B. MDF: Main Distribution Frame.

C. UFER – As defined by Article 100 of the CEC.

1.05 REGULATORY REQUIREMENTS

A. The Contractor shall conform to requirements of the California Electrical Code.

B. The Contractor shall furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the Owner as suitable for purpose specified and as shown.

1.06 PERFORMANCE REQUIREMENTS

A. Grounding system resistance shall be 25 ohms or less unless otherwise indicated.

1.07 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
   1. Test well
   2. Ground rods.
   3. Ground rings.
   4. Grounding arrangements and connections for separately derived systems.
   5. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
   1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems based on EIA/TIA 607 and NFPA 70B.
      a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
      b. Include recommended testing intervals.

1.08 WARRANTY

A. Warranty shall comply with the provisions of Divisions 01, 11, 14, 23, 26, 27, and 28 of these specifications.

1.09 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the International. Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V, unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: comply with ASTM B3.
   2. Stranded Conductors: comply with ASTM B8.
   3. Tinned Conductors: comply with ASTM B33.
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:
   1. No.4 AWG minimum, soft-drawn copper.
   2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.02 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Rods, Conductors and Pipes: Copper or copper alloy, bolted pressure- type, with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Sectional copper-clad, 3/4 inch diameter by10 feet in length. Provide driving pins. Provide threaded couplings where necessary to extend rods.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with non-hazardous electrolytic chemical salts.
   1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
   2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install green insulated, solid conductors for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare, tinned-copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches below grade.
   2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
   2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.
   4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING OVERHEAD LINES

A. Comply with IEEE C2 grounding requirements.

B. Install 2 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

C. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.

D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.

F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.03 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or

handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Comply with Southern California Edison standards.

3.04 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by CEC:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle Circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.
   8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
   9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
   10. Transformers
   11. Switchboards
   12. Switchgear
   13. No. 3/0 AWG green insulated conductor from service entrance ground bar to TMGB located in MDF room.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a

nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide insulated grounding conductor in raceway, from electric utility service entrance grounding electrode system to the following locations unless otherwise shown on Drawings.
   1. No. 4 AWG to Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
   2. No. 4 AWG to Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
   3. No 3/0 AWG to TMGB at MDF.

H. Metal and/or Wood Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.05 INSTALLATION

A. Make mechanical and electrical contact at all panelboards, outlet boxes, junction boxes, and wherever the conduit run is connected. Permanently and effectively ground all conduit and other equipment as required by all applicable codes, regulations, and standards.

B. System neutrals shall only be grounded at the main service and separately derived systems. The service neutral shall be connected to the nearest point, effectively grounding building structural steel, UFER electrode and metal water pipe (within 5 feet of where pipe enters the building). Neutral conductors of separately derived systems shall be connected to effectively grounded building structural steel or a metal water pipe. Ground rods may be used to ground the system neutral conductor only if building steel and water pipes are not available.

C. Grounding Conductors: Install a code sized insulated ground wire in all conduits unless a larger size is indicated on plans. Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

E. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

F. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543, “Underground Ducts and Raceways for Electrical Systems”, and shall be at least 12 inches deep, with cover.
1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

G. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

H. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding electrode conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding electrode conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

I. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

J. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

K. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building area indicated.
1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building foundation.

L. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to CEC, using reinforcing steel or a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
   1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
   2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: An independent, qualified testing and inspecting agency shall perform the following field tests and inspections and prepare test reports.

   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal**,** at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.

   3. Documentation:
      a. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
      b. Furnish original and four copies of the complete report to the Architect in accordance with requirements of Contract Documents.

B. Report measured ground resistances that exceed the following values:
   1. Electrical system maximum ground-resistance value: 25 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified value, extend rod(s) or drive additional rods to meet specified resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 03, 05, 07 and 09 Specification Sections, apply to this Section.

B. Related Sections include the following:
   1. Division 26, Section 260533, “Raceway and Boxes for Electrical Systems”.
   2. Division 26, Section 260548, "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.
   3. Division 26, Section 265100, “Interior Lighting”.
   4. Division 26, Section 265600, “Exterior Lighting”.

1.02 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.03 CODES, REFERENCES, AND STANDARDS

A. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

B. ANSI/AWS D1.1: Structural Welding Code – Steel.

C. American Society for Testing and Materials (ASTM) - ASTM A36/A36M: Standard Specification for Carbon Structural Steel.

D. American Society for Testing and Materials (ASTM) - ASTM A325: Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

E. American Society for Testing and Materials (ASTM) - ASTM A780: Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

F. Metal Framing Manufacturers Association: Standard MFMA-4: Metal Framing Standards Publication.

G. Manufacturers Standardization Society (MSS) - MSS SP-58: Pipe Hangers and Supports - Materials, Design and Manufacture.

H. National Electrical Contractors Association (NECA) - NECA 1: Good Workmanship in Electrical Construction.

I. National Electrical Contractors Association (NECA) - NECA 101: Standard for Installing Steel Conduits (Rigid, IMC, EMT).

J. Society for Protective Coatings SSPC-PA1: Shop, Field, and Maintenance Painting.

1.04 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. PVC: Polyvinyl Chloride.

D. RMC: Rigid metal conduit.

1.05 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.06 SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.

E. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
   1. Trapeze hangers. Include Product Data for components.
   2. Steel slotted channel systems. Include Product Data for components.
   3. Nonmetallic slotted channel systems. Include Product Data for components.
   4. Equipment supports.

F. Welding certificates.

1.07 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with CEC.

1.08 COORDINATION

A. Not Applicable

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Allied Tube and Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. ERICO International Corporation.
      d. GS Metals Corp.
      e. Thomas and Betts Corporation.
      f. Unistrut; Tyco International, Ltd.
      g. Wesanco, Inc.
   2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of

conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened, Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) Hilti Inc.
         2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         3) MKT Fastening, LLC.
         4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) Cooper B-Line, Inc.; a division of Cooper Industries.
         2) Empire Tool and Manufacturing Co., Inc.
         3) Hilti Inc.
         4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         5) MKT Fastening, LLC.
   3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   6. Toggle Bolts: All-steel springhead type.
   7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05, Section 055000, "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by CEC. Minimum rod size shall be 1/4-inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in CEC.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements per approved plans.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05, Section 055000, "Metal Fabrications", for site-fabricated metal supports.

E. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

F. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4-inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03, Section 033000, "Cast-in-Place Concrete".

C. Anchor equipment to concrete base per approved plans.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09, Section 099100, “Painting”, and Section 099600, "High-Performance Coatings", for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 07, 27 and 28 Specification Sections, apply to this Section.

B. Raceways, Fittings, Equipment Racks, Cable Trays, Equipment Cabinets and Enclosures for Data, Communication, and Low Voltage Control Systems are covered under applicable Division 27 and 28 Sections.

C. Related Sections include the following:
   1. Section 260519, "Low Voltage Electrical Power Conductors and Cables".
   2. Section 260526, "Grounding and Bonding for Electrical Systems".
   3. Section 260529, "Hangers and Supports for Electrical Systems".
   4. Section 260543, "Underground Ducts and Raceways for Electrical Systems".
   5. Section 260548, "Vibrations and Seismic Controls for Electrical Systems".
   6. Section 260553, "Identification for Electrical Systems".

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.03 CODES, REFERENCES AND STANDARDS

A. American National Standards Institute (ANSI) – ANSI C80.1: Electrical Rigid Steel Conduit (ERSC).

B. American National Standards Institute (ANSI) – C80.3: Specification for Electrical Metallic Tubing, Zinc Coated (EMT).

C. American National Standards Institute (ANSI) – C80.6: Intermediate Metal Conduit - Zinc Coated (IMC).

D. American National Standards Institute (ANSI) – OS1: Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

E. American National Standards Institute (ANSI) – OS2: Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

F. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

G. American Society for Testing and Materials (ASTM) - ASTM A53/A53M: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

H. EIA/TIA-568-B: Commercial Building Telecommunications Cabling Standards.

I. EIA/TIA-569 – Commercial Building Standard for Telecommunications Pathways.

J. National Electrical Contractors Association (NECA) - NECA 1: Good Workmanship in Electrical Construction.

K. National Electrical Contractors Association (NECA) - NECA 101: Standard for Installing Steel Conduits (Rigid, IMC, EMT).

L. National Electrical Manufacturers Association (NEMA) – NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

M. National Electrical Manufacturers Association (NEMA) – NEMA FB1: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

N. National Electrical Manufacturers Association (NEMA) – NEMA RN1: Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

O. National Electrical Manufacturers Association (NEMA) – NEMA TC2: Electrical Polyvinyl Chloride (PVC) Conduit.

P. National Electrical Manufacturers Association (NEMA) – NEMA TC3: PVC Fittings for Use with Rigid PVC Conduit and Tubing.

Q. Society of Cable Telecommunication Engineers (SCTE) SCTE 77: Specification for Underground Enclosure Integrity.

R. Underwriters Laboratories - UL 94: Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

S. Underwriters Laboratories - UL 514B: Fittings for Conduit and Outlet Boxes.

T. Underwriters Laboratories - UL 886: Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

U. Underwriters Laboratories - UL 1660: Liquid-Tight Flexible Nonmetallic Conduit.

1.04 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquid-tight flexible metal conduit.

F. LFNC: Liquid-tight flexible non-metallic conduit.

G. NBR: Acrylonitrile-butadiene rubber.

H. PVC: Polyvinyl Chloride.

I. RMC: Rigid metallic conduit.

J. RNC: Rigid non-metallic conduit.

1.05 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.
   2. For handholes and boxes for underground wiring, including the following:
      a. Duct entry provisions, including locations and duct sizes.
      b. Frame and cover design.
      c. Grounding details.
      d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
      e. Joint details.

C. Samples for Initial Selection: For wireways, and surface raceways with factory-applied texture and color finishes.
   1. Size: 1 foot.

D. Samples for Verification: For each type of exposed finish required for wireways and surface raceways, prepared on Samples of size indicated below.
   1. Size: 1 foot.

E. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members in the paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

F. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26, Section 260548, "Vibration and Seismic Controls for Electrical Systems". Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the cabinet, enclosure, or raceway will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event".
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity. Locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

G. Qualification Data: For professional engineer and testing agency.

H. Source quality-control test reports.

1.06 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with CEC.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube and Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Manhattan/CDT/Cole-Flex.
6. O-Z Gedney; a unit of General Signal.

B. Rigid Steel Conduit: ANSI C80.1.
1. Standard weight rigid galvanized steel (RGS) conduit shall be hot dipped galvanized or sheradized. All fittings shall be of the screw thread type. Couplings, locknuts, bushings, etc., shall be hot dipped galvanized or sheradized.

C. IMC: ANSI C80.6.

D. PVC-Coated Steel Conduit: PVC-Coated rigid steel conduit where indicated on drawings.
1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040-inch, minimum, interior and exterior surfaces of conduit.
3. Conduit stub-ups from underground including the final 90 degrees sweep and the riser shall be RGS with PVC Coating. PVC Schedule 80 conduit bends will be allowed for all underground bends or sweeps and for vertical risers in lieu of RGS with PVC Coating.

E. EMT: ANSI C80.3.
1. Electric Metallic Tubing (EMT) shall be galvanized or sheradized. Couplings and connectors shall be galvanized or sheradized.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings for Conduit (Including all Types and Flexible and Liquid-tight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed. Indent or drive-on fittings shall not be permitted.
   1. Conduit Fittings for Hazardous (Classified) Locations: (Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G). Comply with UL 886.
   2. Fittings for EMT: Steel, compression type.
   3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040-inch, with overlapping sleeves protecting threaded joints.

I. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 NON-METALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AFC Cable Systems, Inc.
   2. Anamet Electrical, Inc.; Anaconda Metal Hose.
   3. CANTEX Inc.
   4. CertainTeed Corp.; Pipe and Plastics Group.
   5. Lamson and Sessions; Carlon Electrical Products.
   6. Manhattan/CDT/Cole-Flex.
   7. RACO; a Hubbell Company.
   8. Thomas and Betts Corporation.

B. RNC: NEMA TC 2, Type EPC-40-PVC, EPC-80-PVC, unless otherwise indicated.

C. LFNC: UL 1660.

D. Underground bends or sweeps in PVC conduits for vertical risers for feeders and branch circuits shall be according to the following formula, as a minimum: For conduits 2” diameter and smaller, sweep radius shall be six times the diameter; For conduits larger than 2” diameter, sweep radius shall be ten times the diameter.

E. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.03 CONDUIT SIZES

A. The minimum conduit size shall be 3/4-inch for lighting and power branch circuit wiring. The minimum “Homerun” conduit size to any panelboard, load center, switchboard, or motor control center shall be 3/4-inch. For concrete encased duct structures the minimum size shall be 4-inches unless otherwise indicated.

B. The maximum EMT size shall be 4-inches. The minimum EMT size for premise wiring under Division 27, Communications, and Division 28, Electronic Safety and Security shall be 1-inch.

C. Condulets for conduits larger than 1-1/2-inch I.D. shall be of the mogul design secured to the building structure within 6 inches each of conduit connection.

2.04 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type.

E. Finish: Manufacturer's standard enamel finish.

2.05 NON-METALLIC WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Hoffman.
2. Lamson and Sessions; Carlon Electrical Products.

B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.06 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Mono-Systems, Inc.
    b. Thomas and Betts Corporation.
    c. Walker Systems, Inc.; Wiremold Company (The).
    d. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Butler Manufacturing Company; Walker Division.
    b. Enduro Systems, Inc.; Composite Products Division.
    c. Hubbell Incorporated; Wiring Device-Kellems Division.
    d. Lamson and Sessions; Carlon Electrical Products.
    e. Panduit Corp.
    f. Mono-Systems, Inc.
    g. Walker Systems, Inc.; Wiremold Company (The).
    h. Wiremold Company (The); Electrical Sales Division.
2. The raceway and all system components shall be UL listed and exhibit non-flammable, self-extinguishing characteristics, tested to comparable specifications of UL94V-0. The raceway base, cover and divider shall be manufactured of rigid compound.

2.07 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas and Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast or sheet metal semi-adjustable, rectangular.

F. Nonmetallic Floor Boxes: Nonadjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

J. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.

2.08 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.
   1. Color of Frame and Cover: Gray.
   2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
   3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
   4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   5. Cover Legend: Molded lettering, as indicated for each service.
   6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   7. Handholes 12-inches wide by 24-inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Armorcast Products Company.
      b. Carson Industries LLC.
      c. CDR Systems Corporation.
      d. NewBasis.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. Christy Concrete Products.
    d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers products that may be incorporated into the Work include, but are not limited to, the following:
    a. Carson Industries LLC.
    b. Christy Concrete Products.
    c. Nordic Fiberglass, Inc.

2.09 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07, Section 078413, "Penetration Fire-stopping".

2.10 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Advance Products and Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 2 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: Rigid steel conduit.
   2. Concealed Conduit, Aboveground: EMT.
   3. Underground Conduit: Schedule 40 or 80 PVC, direct buried, as indicated.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
   6. Application of Handholes and Boxes for Underground Wiring:
      a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Polymer concrete SCTE 77, Tier 15 structural load rating.
      b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
      c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed, above 8 feet, not subject to Severe Physical Damage: EMT.
   2. Exposed below 8 ft or above 8 feet and subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
      a. Loading docks.
      b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
      c. Mechanical rooms.
   3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   5. Damp or Wet Locations: Rigid steel conduit.
   6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 3R in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. EMT: Compression Type.
   2. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
   3. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install non-ferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. All conduits shall contain an insulated ground wire whether indicated or not. The ground wire shall be sized in accordance with CEC, unless otherwise noted. All conduit systems shall be mechanically and electrically continuous.

C. Keep raceways at least 6-inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

D. Complete raceway installation before starting conductor installation.

E. Support raceways as specified in Division 26, Section 260529, "Hangers and Supports for Electrical Systems."

F. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

G. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

H. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

I. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Change from RNC to rigid steel conduit, before rising above the floor.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12-inches of slack at each end of pull wire. Label each end indicating destination.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with 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:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by CEC.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
   1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
      c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
      d. Attics: 135 deg F temperature change.
   2. Install fitting(s) that provide expansion and contraction for at least 0.00041-inch per foot of length of straight run per deg F of temperature change.
   3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 36-inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31, Section 312000, "Earth Moving", for pipe less than 6-inches in nominal diameter.
   2. Install backfill as specified in Division 31, Section 312000, "Earth Moving".
   3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand-tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12-inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section 31200 "Earth Moving."
   4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
   5. Install manufactured PVC 80 elbows for stub-ups at poles and equipment and at building entrances through the floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3-inches of concrete.

b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60-inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Tape: Warning tape shall be 5.5 mil composition film, 6-inches wide, containing one layer of metalized foil laminated between two (2) layers of inert plastic film, specifically formulated for prolonged use underground. Tape shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Warning tape shall bear a continuous printed message warning of the exact location of underground installations. The message shall be in permanent ink specifically formulated for prolonged use underground. Tape shall have black letters (minimum 1/2-inch high) on red background with the message “ELECTRICAL” printed on twelve (12) inch centers for the entire length of the tape.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level 6-inch deep bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1-inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07, Section 078413, "Penetration Fire-stopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16-inches, thickness shall be 0.052-inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50-inches and 1 or more sides equal to, or greater than, 16-inches, thickness shall be 0.138-inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with fire-stop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2-inches above finished floor level unless otherwise noted.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry, and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07, Section 079200, "Joint Sealants", for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with fire-stop materials. Comply with Division 07, Section 078413, "Penetration Fire-stopping".

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.06 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.07 FIRESTOPPING

A. Apply fire-stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Fire-stopping materials and installation requirements are specified in Division 07, Section 078413, "Penetration Fire-stopping."

3.08 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 03 and 07 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and single duct runs.
   2. Handholes and pull boxes.
   3. Manholes.

1.03 CODES, STANDARDS AND REFERENCES

A. AASHTO HB 17: Standard Specifications for Highway Bridges.

B. American National Standards Institute (ANSI) – ANSI C80.1: Electrical Rigid Steel Conduit (ERSC).

C. American Society for Testing and Materials (ASTM) - ASTM A48/A48M: Standard Specification for Gray Iron Castings.

D. American Society for Testing and Materials (ASTM) - ASTM C270: Standard Specification for Mortar for Unit Masonry.

E. American Society for Testing and Materials (ASTM) - ASTM C387: Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

F. American Society for Testing and Materials (ASTM) - ASTM C858: Standard Specification for Underground Precast Concrete Utility Structures.

G. American Society for Testing and Materials (ASTM) - ASTM C891: Standard Practice for Installation of Underground Precast Concrete Utility Structures.

H. American Society for Testing and Materials (ASTM) - ASTM C1037: Standard Practice for Inspection of Underground Precast Concrete Utility Structures.

I. American Society for Testing and Materials (ASTM) - ASTM E329: Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

J. American Society for Testing and Materials (ASTM) - ASTM F512: Standard Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation.

K. ANSI/IEEE C2: National Electrical Safety Code (NESC).

L. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

M. National Electrical Manufacturers Association (NEMA) – NEMA TC2: Electrical Polyvinyl Chloride (PVC) Conduit.

N. National Electrical Manufacturers Association (NEMA) – NEMA TC3: PVC Fittings for Use with Rigid PVC Conduit and Tubing.

O. National Electrical Manufacturers Association (NEMA) – NEMA TC6 and 8: PVC Plastic Utilities Duct for Underground Installations.

P. Society of Cable Telecommunication Engineers (SCTE) SCTE 77: Specification for Underground Enclosure Integrity.

Q. Underwriters Laboratories - UL651: Schedule 40 and 80 Rigid PVC Conduit.

1.04 DEFINITION

A. PVC: Polyvinyl Chloride

A. RNC: Rigid nonmetallic conduit.

1.05 SUBMITTALS

A. Product Data: For the following:
1. Duct bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for manholes, handholes, pull boxes, and other utility structures.
4. Warning tape.
5. Cementitious Waterproofing System.

B. Shop Drawings for Pre-cast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.
3. Frame and cover design and manhole frame support rings.
4. Ladder and Step details.
5. Grounding details.
6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
7. Joint details.

C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Pre-cast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
   1. Duct entry provisions, including locations and duct sizes.
   2. Cover design.
   3. Grounding details.
   4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

D. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
   1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
   2. Drawings shall be signed and sealed by a qualified professional engineer.

E. Product Certificates: For concrete and steel used in pre-cast concrete manholes and handholes, as required by ASTM C858.

F. Qualification Data: For professional engineer and testing agency.

G. Source quality control test reports.

H. Field quality control test reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with CEC.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store non-metallic ducts with supports to prevent bending, warping, and deforming.

B. Store pre-cast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support pre-cast concrete units only at designated lifting or supporting points.

1.08 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
   1. Notify Architect no fewer than two days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Architect's written permission.

1.09 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Elevations of ducts and duct bank entrances shall be a minimum of 12-inches from the bottom of manholes. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

PART 2 - PRODUCTS

2.01 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.02 NON-METALLIC DUCTS AND DUCT ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe and Plastics Group.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson and Sessions; Carlon Electrical Products.

10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

B. Underground Plastic Utilities Duct: NEMA TC 6 and 8, Type DB-40-PVC, Type DB-80-PVC, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

C. Duct Accessories:
1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Division 26, Section 260553, "Identification for Electrical Systems."

2.03 PRECAST CONCRETE HANDHOLES AND BOXES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Associated Concrete Products, “Quickset” #1000-3/6/RPM-1000.
2. Carder Concrete Products.
3. Christy Concrete Products.
4. Elmhurst-Chicago Stone Co.
5. Oldcastle Precast Group.
6. Riverton Concrete Products; a division of Cretex Companies, Inc.
7. San Diego Precast Concrete.
8. Utility Concrete Products, LLC.
9. Utility Vault Co.
10. Wausau Tile, Inc.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Description: Factory-fabricated, reinforced concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
   a. Cover Hinges: Concealed, with hold-open ratchet assembly.
   b. Cover Handle: Recessed.
4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
   a. Cover Hinges: Concealed, with hold-open, ratchet assembly.
   b. Cover Handle: Recessed.
5. Cover Finish: Non-skid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.", "TELEPHONE.", COMMUNICATION.”, as indicated for each service.

7. Configuration: Units shall be designed for flush burial and have open or closed bottom, as indicated on drawings.
8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    a. Extension shall provide increased depth of 12-inches .
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
9. Windows: Pre-cast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12-inches vertically and horizontally to accommodate alignment variations.
    a. Windows shall be located no less than 6-inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
    a. Type and size shall match fittings to duct or conduit to be terminated.
    b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
    c. Duct entrances in handholes shall be a minimum of 6-inches above the bottom of handholes.
11. Handholes, 12-inches wide by 24-inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.04 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.
1. Color: Gray.
2. Configuration: Units shall be designed for flush burial and have open or closed bottom, as indicated on drawings.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Non-skid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.", "TELEPHONE.", “COMMUNICATION.”, as indicated for each service.
6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12-inches wide by 24-inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation.
    d. NewBasis.

C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. Christy Concrete Products.
    d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of hot-dip galvanized-steel diamond plate.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Carson Industries LLC.
    b. Christy Concrete Products.
    c. Nordic Fiberglass, Inc.

E. High-Density Plastic Boxes: Injection molded of high-density polyethylene or copolymer-polypropylene. Cover shall be hot-dip galvanized-steel diamond plate.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Carson Industries LLC.
    b. Nordic Fiberglass, Inc.
    c. PenCell Plastics.

2.05 PRECAST MANHOLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Carder Concrete Products.
2. Christy Concrete Products.
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Riverton Concrete Products; a division of Cretex Companies, Inc.
6. San Diego Precast Concrete.
7. Utility Concrete Products, LLC.
8. Utility Vault Co.

9. Wausau Tile, Inc.

B. Comply with ASTM C 858, with structural design loading as specified in Part 3 "Underground Enclosure Application" Article and with interlocking mating sections, complete with accessories, hardware, and features.
   1. Windows: Pre-cast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12-inches vertically and horizontally to accommodate alignment variations.
      a. Windows shall be located no less than 6-inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
      b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
      c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
   2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
      a. Type and size shall match fittings to duct or conduit to be terminated.
      b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.
      c. Duct entrances shall be elevated to prevent water entering the duct banks.

C. Concrete Knockout Panels: 1-1/2 to 2-inches thick, for future conduit entrance and sleeve for ground rod.

D. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground water level at grade.

2.06 CAST-IN-PLACE MANHOLES

A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

B. Materials: Comply with ASTM C 858 and with Division 03 Section 033000, "Cast-in-Place Concrete."

C. Structural Design Loading: As specified in Part 3 "Underground Enclosure Application" Article.

2.07 UTILITY STRUCTURE ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Bilco Company (The).
   2. Brooks.
   3. Campbell Foundry Company.
   4. Carder Concrete Products.

5. Christy Concrete Products.
6. East Jordan Iron Works, Inc.
7. Elmhurst-Chicago Stone Co.
8. McKinley Iron Works, Inc.
9. Neenah Foundry Company.
10. NewBasis.
11. Oldcastle Precast Group.
12. Osburn Associates, Inc.
13. Pennsylvania Insert Corporation.
14. Quickset.
15. Riverton Concrete Products; a division of Cretex Companies, Inc.
16. San Diego Precast Concrete.
17. Strongwell Corporation; Lenoir City Division.
18. Underground Devices, Inc.
19. Utility Concrete Products, LLC.
20. Utility Vault Co.
21. Wausau Tile, Inc.

B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
   1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 29-inches .
      a. Cover Finish: Non-skid finish shall have a minimum coefficient of friction of 0.50.
      b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
   2. Cover Legend: Cast in. Selected to suit system.
      a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
      b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
      c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
   3. Manhole Chimney Components: Pre-cast concrete rings with dimensions matched to those of roof opening.
      a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.

C. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch diameter eye, and 1-by-4-inch bolt.
   1. Working Load Embedded in 6-Inch , 4000-psi Concrete: 13,000-lbf minimum tension.

E. Pulling Eyes in Non-concrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch-diameter eye, rated 2500-lbf minimum tension.

F. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
   1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

G. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of non-corrosive, chemical-resistant, non-conductive thermoplastic material; 1/2-inch ID by 2-3/4-inches deep, flared to 1-1/4-inches minimum at base.
   1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

H. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

I. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.
   1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.
   2. Arms: 1-1/2-inches wide, lengths ranging from 3-inches with 450-lb minimum capacity to 18-inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
   3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

J. Cable Rack Assembly: Non-metallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
   1. Stanchions: Nominal 36-inches high by 4-inches wide, with minimum of 9 holes for arm attachment.
   2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3-inches with 450-lb minimum capacity to 20-inches with 250-lb minimum capacity. Top of arm shall be nominally 4-inches wide, and arm shall have slots along full length for cable ties.

K. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable of insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature 300 deg F. without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

L. Fixed Manhole Ladders: Arranged for attachment to roof or wall and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.

M. Portable Manhole Ladders: UL-listed, heavy-duty fiberglass specifically designed for portable use for access to electrical manholes. Minimum length equal to distance from deepest manhole floor to grade plus 36-inches. One required.

N. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two required.

2.08 SOURCE QUALITY CONTROL

A. Test and inspect pre-cast concrete utility structures according to ASTM C 1037.

B. Non-concrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   1. Tests of materials shall be performed by a independent testing agency.
   2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
   3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.01 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-80, EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RNC**,** NEMA Type EPC-80, EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-80, EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

D. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

E. Underground Ducts Crossing Paved Paths, Walks, Driveways, Roadways, and Railroads: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.02 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
   1. Units in Roadways and Other Deliberate Traffic Paths: Pre-cast concrete. AASHTO HB-17, H-20 structural load rating.
   2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Pre-cast concrete, AASHTO HB 17, H-20, structural load rating.
   3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Pre-cast concrete, AASHTO HB 17, H-10 structural load rating.
   4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Manholes: Pre-cast concrete.
   1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
   2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.03 EARTHWORK

A. Excavation and Backfill: Comply with Division 31, Section 312000, "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32, Section 329200, "Turfs and Grasses" and Section 329300, "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section 017329, "Cutting and Patching."

3.04 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48-inches, both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10-inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
   2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to concrete encased rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls

as specified in Divisions 26, 27, 28, Sections 260500, 270500, 280500, "Common Work Results for Electrical", "Common Work Results for Communications", "Common Work Results for Electronic Safety and Security" respectively.

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 200-lbf- test nylon cord in ducts, including spares.

H. Concrete-Encased Ducts: Support ducts on duct separators.
   1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6-inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
   2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
      a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
      b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18-inches into concrete on both sides of joint near corners of envelope.
   3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
   4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
   5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
   6. Minimum Space between Ducts: 3-inches between ducts and exterior envelope wall, 3-inches between ducts for like services, and 12-inches between power and signal ducts.
   7. Depth: Install top of duct bank at least 24-inches below finished grade in areas not subject to deliberate traffic, and at least 30-inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
   8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
   9. Warning Tape: Bury warning tape approximately 12-inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3-inches of the

centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct bank width over a nominal 18-inches. Space additional tapes 12-inches apart, horizontally.

I. Direct-Buried Duct Banks:
   1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
   2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6-inches between tiers.
   3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31, Section 312000, "Earth Moving" for pipes less than 6-inches in nominal diameter.
   4. Install backfill as specified in Division 31, Section 312000, "Earth Moving."
   5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4-inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31, Section 312000, "Earth Moving."
   6. Install ducts with a minimum of 3-inches between ducts for like services and 12-inches between power and signal ducts.
   7. Depth: Install top of duct bank at least 36-inches below finished grade, unless otherwise indicated.
   8. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
   9. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
      a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3-inches of concrete.
      b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60-inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.05 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Cast-in-Place Manhole Installation:
   1. Finish interior surfaces with a smooth-troweled finish.
   2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2-inches thick, arranged as indicated.
   3. Cast-in-place concrete, formwork, and reinforcement are specified in Division 03, Section 033000 "Cast-in-Place Concrete."

B. Pre-cast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level 6-inch bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:
1. Manhole Roof: Install with rooftop at least 15-inches below finished grade.
2. Manhole Frame: In paved areas and traffic paths, set frames flush with finished grade. Set other manhole frames 1-inch above finished grade.
3. Install handholes with bottom below the frost line, (Depth of frost line below grade shall be dependent upon soil conditions at Project site), below grade.
4. Handhole Covers: In paved areas and traffic paths, set surface flush with finished grade. Set covers of other handholes 1-inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

E. Manhole Access: Circular opening in manhole roof; sized to match cover size.
1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of pre-cast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

F. Waterproofing: Apply waterproofing membrane to exterior surfaces of manholes and handholes, after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07, Section 071353, "Elastomeric Sheet Waterproofing", and Section 071354, "Thermoplastic Sheet Waterproofing". After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

G. Cementitious Waterproofing System:
1. Waterproofing manholes and vaults shall be performed by a Contractor who is familiar with waterproofing work. The Contractor shall check all work or surfaces to receive cementitious waterproofing and report all conditions which interfere or will prevent the proper execution of this section. The Contractor shall have the manufacturer's representative advise and/or supervise on waterproofing application.
2. All concrete surfaces must be solid and free of all latent oils, grease, curing agents, or other foreign materials.
3. The waterproofing treated area must be kept clear for at least 48-hours before backfilling or applying any concrete screen or other topping.
4. The waterproofing treated area must be protected from temperatures below 40 degrees F during application and for 24 hours after application.

H. Damp-proofing: Apply damp-proofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Damp-proofing materials and installation are specified in Division 07, Section 071113, "Bituminous Damp-proofing." After ducts have been connected and grouted, and before backfilling, damp-proof joints and connections and touch up abrasions and scars. Damp-proof exterior of manhole chimneys after mortar has cured at least three days.

I. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

J. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

K. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8-inches for manholes and 2-inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

L. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.06 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level 6-inch bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and traffic paths, set so cover surface will be flush with finished grade. Set covers of other handholes 1-inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving, and subject to occasional, non-deliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Division 03, Section 033000, "Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10-inches wide by 12-inches deep.

3.07 GROUNDING

A. Ground underground ducts and utility structures according to Division 26, Section 260526, "Grounding and Bonding for Electrical Systems."

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test manhole, and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26, Section 260526, "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.09 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 27 and 28 Specification Sections, apply to this Section.

B. Related Sections include the following:
1. Division 26, Section 260529, "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.
2. Division 26, Section 260533, “Raceway and Boxes for Electrical Systems”.
3. Division 26, Section 262200, “Low Voltage Transformers”.
4. Division 26, Section 262413, “Switchboards”.
5. Division 26, Section 262416, “Panelboards”.
6. Division 26, Section 265100, “Interior Lighting”.
7. Division 26, Section 265600, “Exterior Lighting”.

1.2 SUMMARY

A. This Section includes the following:
1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

1.3 CODES, STANDARDS, AND REFERENCES

A. American National Standards Institute (ANSI) – ANSI AWS D1.1/D1.1M: Structural Welding Code – Steel.

B. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

C. American Society for Testing and Materials (ASTM) - ASTM A603: Standard Specification for Zinc-Coated Steel Structural Wire Rope.

D. American Society for Testing and Materials (ASTM) – ASTM E488: Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.

E. California Code of Regulations (CCR) Title 24, Part 2: California Building Code (CBC).

F. International Code Council – International Building Code (IBC).

G. Metal Framing Manufacturers Association Standard MFMA-3: Metal Framing.

H. Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

1.4 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service, Inc.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:
   1. Site Class: As Defined in the IBC and California Building Code, Ch. 1629A.3.1.
   2. Assigned Seismic Use Group or Building Category: As Defined in the IBC and Title 24.
      a. Component Importance Factor: 1.5.
      b. Component Response Modification Factor: 3.5.
      c. Component Amplification Factor: 1.0.
      d. Design Spectral Response Acceleration at Short Periods (0.2 Second): Per design calculations of a registered professional design engineer.
      e. Design Spectral Response Acceleration at 1.0-Second Period: Per design calculations of a registered professional design engineer.

1.6 SUBMITTALS

A. Product Data: For the following:
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
      b. Annotate to indicate application of each product submitted and compliance with requirements.
   3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations shall be per approved structural plans.
   2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices per approved structural plans.

3. Field-fabricated supports (shall comply with approved structural plans).
4. Seismic-Restraint Details shall be per approved structural plans.
    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing's. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Pre-approval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
    1. All testing must be supervised by an independent registered professional engineer.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage pre-approval OPA number from OSHPD, pre-approval by ICC-ES, or pre-approval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with CEC.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS Shall have OPA numbers.

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Amber/Booth Company, Inc.
   2. Kinetics Noise Control.
   3. Mason Industries.
   4. Vibration Eliminator Co., Inc.
   5. Vibration Mountings & Controls, Inc.

B. Pads: ¾" thick elastomeric pad with steel plate, of sufficient stiffness for uniform loading over pad area, molded with a non-slip pattern, and factory cut to sizes that match requirements of supported equipment.
   1. Resilient Material: Oil- and water-resistant neoprene.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
   1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   5. Neoprene cup or pad bonded to spring baseplates.
   6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
   1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed and acts as blocking during installation; factory-drilled baseplate, and adjustable equipment mounting and leveling bolt.
   2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
   3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   7. Neoprene cup or pad bonded to spring baseplate.

2.2 SEISMIC-RESTRAINT DEVICES Shall have OPA numbers.

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Amber/Booth Company, Inc.

2. Mason Industries.
3. Kinetics Noise Control.
4. Vibration Eliminator Co., Inc.
5. Vibration Mounting & Controls, Inc.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by OSHPD, or an agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least two times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603, pre-stretched, galvanized -steel cables with end connections made of steel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement for loads exceeding 500 lbs.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
   1. Powder coating on springs and housings.
   2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
   3. Baked enamel or powder coat for metal components on isolators for interior use.
   4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints shall be per approved structural plans:
   1. Install restrained isolators on electrical equipment.
   2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
   3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members, pending acceptance by the project structural engineer..

D. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
   5. Set anchors to manufacturer's recommended torque, using a torque wrench.
   6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
   2. Schedule test with Construction Manager, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
   3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
   4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
   5. Test to 90 percent of rated proof load of device.
   6. Measure isolator restraint clearance.

7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports. Furnish original and four copies of the complete report to the Architect in accordance with requirements of Contract Documents.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 ELECTRICAL VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Supported or Suspended Equipment: As specified and shown on drawings.
1. Equipment Location: As indicated on drawings.
2. Pads:
   a. Material: Neoprene.
   b. Thickness: As indicated on drawings.
   c. Durometer: As indicated on drawings.
   d. Number of Pads: ¾ inch thick pads as specified on drawings.
3. Isolator Type: Free standing, steel, open-spring, laterally stable, or with seismic or limit-stop restraint.
4. Component Importance Factor: 1.5.
5. Component Response Modification Factor: 3.5.
6. Component Amplification Factor: 1.0.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 and 09 Specification Sections, apply to this Section.

B. Related Sections include the following:
1. Division 26, Section 260519, “Low Voltage Electrical Power Conductors and Cables”.
2. Division 26, Section 260526, “Grounding and Bonding for Electrical Systems”.
3. Division 26, Section 260533, “Raceway and Boxes for Electrical Systems”.
4. Division 26, Section 260543, “Underground Ducts and Raceways for Electrical Systems”.
5. Division 26, Section 260923, “Lighting Control Devices".
6. Division 26, Section 260943, "Network Lighting Controls".
7. Division 26, Section 262200, “Low Voltage Transformers”.
8. Division 26, Section 262413, “Switchboards”.
9. Division 26, Section 262416, “Panelboards”.
10. Division 26, Section 262726, "Wiring Devices".

1.2 SUMMARY

A. This Section includes the following:
1. Identification for raceway and metal-clad cable.
2. Identification for power conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Conduit Markers.
8. Miscellaneous identification products.

1.3 CODES, STANDARDS, AND REFERENCES

A. American National Standards Institute (ANSI) – ANSI Z35.1: Accident Prevention Signs.

B. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.

C. ANSI/IEEE C2: National Electrical Safety Code (NESC).

D. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

E. California Code of Regulations (CCR) Title 8.

F. California Code of Regulations (CCR) Title 24: California Building Standards Code.

G. Code of Federal Regulations (CFR) - 29 CFR 1910.145: Accident Prevention Tags.

H. Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

I. State and Local Codes and Ordinances.

1.4 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.5 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with CEC.

C. Comply with 29 CFR 1910.145.

D. Comply with ANSI A13.1 and CEC for color-coding.

E. Comply with ANSI Z35.

F. Comply with California Code of Regulations (CCR) Title 8 and Title 24.

1.6 REGULATORY REQUIREMENTS

A. This Section includes electrical identification materials and devices required to comply with ANSI C2, CEC, OSHA standards.

1.7 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
   2. Color: Black letters on orange field.
   3. Color tracer on neutral conductors for identification.
   4. Legend: Indicate system or service and voltage, if applicable.
   5. Control Circuits: Control wire numbers indicated on schematic or interconnection diagrams on shop drawings.

C. Self-Adhesive Vinyl Labels: Pre-printed, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, 2-inches wide, fade resistant, compounded for outdoor use.

E. Raceways/Conduits Identification Labels:
   1. All signal systems and lighting systems shall be identified with weather-resistant, fade-resistant labels identifying the system. Each system shall be color-coded as described below.
   2. Labels shall be placed by Electrical and/or Low Voltage Contractor on every conduit run, within 2 feet of every junction box or connector, and each 10 feet thereafter (1 label per every 10 feet of conduit). Labels shall wrap around conduit and placed for maximum visibility.
   3. All junction boxes, not otherwise identified, shall have a system identification label on the cover.
   4. A laminated schedule shall be posted in each electrical, mechanical, and signal room, showing each label and the system it identifies.
   5. Label Colors:

System Type	Identification	Background	Lettering
Lighting and Power Voltage	Standard	Orange	White
Cable Television	CATV	Brown	White
Clock	CLOCK	Black	White
Data	DATA	Violet	White
Emergency Circuits	EMERG	Yellow	Black
Energy Management System	EMS	White	Black
Fiber Optic System	FIBER	Pink	Black
Fire Alarm	FIRE	Red	White
Independent Public Address	IPA	Gray	White
Security/Intrusion	SECUR	Green	White
Telecommunications	TELECOM	Blue	White

   6. Label Sizes:

System Type	Size	Background	Lettering

Lighting and Power	2”(w) x3”(h)	Orange	3/8” White
Cable TV System	2”(w) x3”(h)	Brown	3/8” White
Clock System	2”(w) x3”(h)	Black	3/8” White
Data System	2”(w) x3”(h)	Violet	3/8” White
Emergency Circuits	2”(w) x3”(h)	Yellow	3/8” Black
Energy Management System	2”(w) x3”(h)	White	3/8” Black
Fiber Optic System	2”(w) x3”(h)	Pink	3/8” Black
Fire Alarm System	2”(w) x3”(h)	Red	3/8” White
Independent Public Address	2”(w) x3”(h)	Gray	3/8” White
Security/Intrusion System	2”(w) x3”(h)	Green	3/8” White
Telecommunication System	2”(w) x3”(h)	Blue	3/8” White

2.2 POWER, COMMUNICATION, AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2-inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05-inch, with stamped legend, punched for use with self-locking nylon tie fastener.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
1. Not less than 6-inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with CEC and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7-inches by 10-inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14-inches.

E. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING – OSHA REGULATION – AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST HAVE 36-INCHES CLEARANCE", or greater as required by Code.

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 sq. in. and 1/8-inch thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8-inch.

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8-inch.

E. Stenciled Legend: In non-fading, waterproof, black ink or paint. Minimum letter height shall be 1-inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
   1. Minimum Width: 3/16-inch.
   2. Tensile Strength: 50 lb., minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 09, Section 099100, “Painting”.
   1. Exterior Ferrous Metal:
      a. Semi-gloss Alkyd-Enamel Finish: Two finish coats over a primer.
         1) Primer: Exterior ferrous-metal primer.
         2) Finish Coats: Exterior semi-gloss alkyd enamel.
   2. Exterior Zinc-Coated Metal (except Raceways):
      a. Semi-gloss Alkyd-Enamel Finish: Two finish coats over a primer.

1) Primer: Exterior zinc-coated metal primer.
2) Finish Coats: Exterior semi-gloss alkyd enamel.

3. Interior Ferrous Metal:
   a. Semi-gloss Acrylic-Enamel Finish: Two finish coats over a primer.
      1) Primer: Interior ferrous-metal primer.
      2) Finish Coats: Interior semi-gloss acrylic enamel.

4. Interior Zinc-Coated Metal (except Raceways):
   a. Semi-gloss Acrylic-Enamel Finish: Two finish coats over a primer.
      1) Primer: Interior zinc-coated metal primer.
      2) Finish Coats: Interior semi-gloss acrylic enamel.

C. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
   1. Fire Alarm System: Red.
   2. Fire-Suppression Supervisory and Control System: Red and yellow.
   3. Combined Fire Alarm and Security System: Red and blue.
   4. Security System: Blue and yellow.
   5. Mechanical and Electrical Supervisory System: Green and blue.
   6. Telecommunication System: Green and yellow.
   7. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and non-metallic tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape and non-metallic tags. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach write-on tags and marker tape to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with white letters on an orange background. Apply to exterior of door, cover, or other access.
   1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.
   2. Equipment Requiring Workspace Clearance According to CEC : Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

I. Instruction Signs:
   1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
   2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer or load shedding.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where 2 lines of text are required, use labels 2-inches high.
      b. Outdoor Equipment: Engraved, laminated acrylic or melamine label 4-inches high.
      c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   2. Equipment to Be Labeled:
      a. Panelboards, electrical cabinets, and enclosures.
      b. Access doors and panels for concealed electrical items.
      c. Electrical switchgear and switchboards (existing related to project).
      d. Transformers.
      e. Emergency system boxes and enclosures.
      f. Motor-control centers.
      g. Disconnect switches.

h. Enclosed circuit breakers.
i. Motor starters.
j. Push-button stations.
k. Power transfer equipment.
l. Contactors.
m. Remote-controlled switches, dimmer modules, and control devices.
n. Battery inverter units.
o. Battery racks.
p. Power-generating units.
q. Voice and data cable terminal equipment.
r. Master clock and program equipment.
s. Intercommunication and call system master and staff stations.
t. Television/audio components, racks, and controls.
u. Fire-alarm control panel and annunciators.
v. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
w. Monitoring and control equipment.
x. Uninterruptible power supply equipment.
y. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non-adhesive signs and plastic labels with stainless steel screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Vinyl Labels for Raceways and Cables: Each vinyl label shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate labels at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
3. Colors for 480/277-V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.

4. Colors for DC Circuits:
   a. Negative: Black.
   b. Positive: Red.
5. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6-inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09, Section 099100, “Painting”.

END OF SECTION

SECTION 26 08 00

SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section Includes:

1. General requirements for Commissioning (Cx) of lighting systems components, lighting controls, including installation, start-up, testing and documentation according to Construction Documents and Commissioning Plan (CxP).
2. Standard procedures for the execution of commissioning work shall be in conformance with Division 1, Section 01 9113 General Commissioning Requirements. Coordinate work with the Commissioning Agent (CxA).

1.2 RELATED REQUIREMENTS:

A. Division 01 - General Requirements.

B. Section 01 9113: General Commissioning Requirements.

C. Section 01 7900: Maintenance and Operations Staff Demonstration and Training.

D. Section 26 0500: Common Work Results for Electrical.

E. Section 26 0526: Grounding and Bonding.

F. Section 26 0519: Low Voltage Wires (600 Volt AC).

G. Section 26 5100: Interior Lighting.

H. Section 26 0923: Lighting Control Devices.

I. Project Commissioning Plan.

1.3 REFERENCES

A. Applicable codes, standards, and references: inspections and tests shall be in accordance with the following applicable codes and standards:
1. National Electrical Testing Association – NETA.
2. National Electrical manufacturer's Association – NEMA.
3. American Society for Testing and Materials – ASTM.
4. Institute of Electrical and Electronic Engineers – IEEE.
5. American National Standards Institute – ANSI.
6. National Electrical Safety Code – NESC.
7. California Building Code – CBC.
8. California Electrical Code – CEC.
9. California Green Building Standards Code (CalGreen).

10. United States Green Building Council, Leadership Energy and Environmental Design (USGBC) (LEED).
11. Conglomerate for High Performance Schools (CHPS).
12. Insulated Power Cables Engineers Association – IPCEA.
13. Occupational Safety and Health Administration – OSHA.
14. National Institute of Standards and Technology – NIST.
15. National Fire Protection Association – NFPA.
16. ANSI/NFPA 70 – National Electrical Code.
17. ANSI/NFPA 70B – Electrical Equipment Maintenance.
18. NFPA 70E – Electrical Safety Requirements for Employee Work Places.
19. ANSI/NFPA 101– Life Safety Code.

1.4 SUBMITTALS

A. Submittals shall include the following:
1. Submit required Cx submittals in accordance with Division 1 Specification Sections.
2. Copy of the Architect's reviewed and accepted submittals to the CxA via the OAR.
3. List of team members who will represent the Contractor in the Pre-functional Equipment Checks and Functional Performance Testing, at least two weeks prior to the start of Pre-functional Equipment Checks.
4. Detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, checklist documentation and field checklist forms to be used by factory or field technicians, and a copy of full details of Owner-contracted tests, full factory testing reports, if any, and Warranty information, including responsibilities of Owner to keep Warranty in force, clearly defined.
5. Detailed manufacturer's recommended procedures and schedules for Pre-functional Equipment Checks, supplemented by Contractor's specific procedures, and Pre-functional Tests, at least four weeks prior to the start of Pre-functional Performance Tests.
6. After facility's commission is complete, submit completed Pre-functional Equipment Checklists and Functional Performance Test checklists organized by system and by subsystem. Bind information in a single package. The results of failed tests shall be included along with a description of the corrective actions taken.

1.5 MEETINGS, SEQUENCING AND SCHEDULING

A. Meetings: Attend (Cx) meetings as required under Section 01 9113 and the Cx Plan.

B. Sequencing and Scheduling: The work described in this Section shall begin only after work required in related Division 26 Sections has been successfully completed, and tests, inspection reports and Operation and Maintenance manuals required in Division 26 Sections have been submitted and approved. The start-up and Pre-functional Equipment Checklists shall be completed and submitted to the Owner's Authorized Representative (OAR) prior to the Functional Performance Tests. Refer to the project Cx Plan for more details.
1. Coordinate electrical work with the work of other trades prior to scheduling of any Cx procedures.
2. Coordinate the completion of electrical testing, inspection, and calibration prior to start of Cx activities.
3. Cx activities shall be scheduled in accordance with project's Cx plan.

1.6 QUALITY CONTROL

A. Comply with Owner’s Quality Control Specifications, Sections 01 4516 – 01 4519, as applicable.

B. Incorporate manufacturer's recommended Cx procedures for the systems and equipment to be commissioned under this Section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Equipment to be utilized in the commissioning process shall meet the following requirements:
   1. Provide test equipment as necessary for the equipment and systems to be commissioned.
   2. Provide testing equipment and accessories that are free of defects and certified for use.
   3. Provide testing equipment with current calibration labels per NIST Standards.
   4. Testing equipment shall be UL Listed.

PART 3 – EXECUTION

3.1 COMMISSIONING PROCESS REQUIREMENTS

A. Work to be performed prior to commissioning:
   1. Complete all phases of the work so the system(s) can be started, tested, adjusted, balanced, and otherwise commissioned.
   2. Start-up services required to bring each system into full operational state and ready for functional performance testing:
      a. Completion of pre-functional checklists.
      b. Manufacturer’s Authorized Representative Start-up as required
      c. Contractor start-up
      d. Testing.
      e. Motor rotation check.
      f. Control sequences of operation.
      g. Full and part load performance.
   3. If modifications or corrections to the installed systems are required to bring the system(s) to acceptance levels due to Contractor’s incorrect installation or defective materials, such modifications or corrections shall be made at no additional cost to the Owner.
   4. Start-up services required to bring each system into full operational state and ready for functional performance testing:

a. Completion of pre-functional checklists.

b. Manufacturer's Authorized Representative Start-up as required

c. Contractor start-up

d. Testing.

e. Motor rotation check.

f. Control sequences of operation.

g. Full and part load performance.

5. Commissioning shall not start until each system is complete and the above items are completed and approval has been received by the OAR

B. Pre-commissioning Responsibilities: Inspection, calibration and testing of the equipment and apparatuses to commission the following systems:
1. Electrical Lighting Systems.
2. Lighting Controls.

C. Commissioning Process Requirements:
1. Refer to Section 01 9113 General Commissioning Requirements, related sections and Cx Plan for information on meetings, start-up plans, Pre-Functional and Functional Performance Testing (FPT), operations and maintenance data, and other Commissioning activities.

3.2 PREPARATION

A. Provide certified electricians or other qualified personnel as required with tools and equipment necessary to perform Cx activities.

B. Provide equipment manufacturer's factory representative(s) for commissioning of classrooms lighting and its control system, Theatrical Lighting Controls, and Energy Management and Environmental Control Systems as required by the Cx Plan.

C. Provide certified testing agency personnel or report(s) as required in the Cx Plan.

3.3 TESTING

A. Testing documentation shall include the following minimum information:
1. Test number.
2. Equipment used for the test, with manufacturer and model number and date of last calibration.
3. Date and time of the test.
4. Indication of whether the record is the first commissioning test or a retest following correction of a previously identified problem or issue.
5. Identification of the system, subsystem, assembly, or equipment.
6. Conditions under which the test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of the test.

7. Systems and assemblies test results, performance and compliance with contract requirements.
8. Issue number, if any, generated as the result of the test.
9. Name and signature(s) of witnesses and the person(s) performing the test.

B. Test lighting and controls systems performance to verify operation, functionality, light levels, energy usage, and compliance with construction documents.
1. Start up, test and document results under the observation of the CxA.
2. Execute the Functional Performance Test (FPT) under the observation of the CxA who will record the results of the Functional Performance Test procedures.
3. Equipment and Components to be tested: Refer to Article 3.01, B.
4. Functions and Testing Conditions:

a. Occupancy sensors and timer controls for lighting:
1) Verify that specified functions and features are set up, debugged and fully operable at time of test.
2) Verify that occupant override feature functions properly and as intended in the contract documents.
3) Verify that sensor durations are set properly.
4) Test the sequence of operation for features and modes and confirm that adjustable timing matches the design specifications and contract documents.

b. Electric lighting dimming, photocells and controls:
1) Test the dimming controls during daytime when conditions are such that controls should be dimming electric lighting. Verify that amperage changes in light fixtures are proportional to external light changes. Verify that dimmed light levels at the specified work plane remain within specified limits.
2) Verify that delays and ramp times are set and functioning so that the speed of change of light fixture output is slow enough to not bother occupants and in compliance with the specifications.
3) Verify that dimming does not cause lower than specified light levels in adjacent “non-dimmed” spaces.
4) Verify that the controls and sensors cannot be easily overridden or disabled by occupants.
5) Verify that dimming systems in places of assembly are interfaced with the Central Fire Alarm system. Dimmed lighting in these areas shall come back to full bright during a fire alarm condition.

c. Illumination Levels, Night Conditions:
1) Verify that lighting throughout the building is operating automatically.
2) Test with doors closed (to simulate actual occupancy) and after finishes are complete.

d. Illumination Levels, Day Conditions:
1) Verify that lighting throughout the building is operating automatically.
2) Test with doors closed (to simulate actual occupancy), after finishes are complete, and room is furnished.

3) Test at different times during the day, or under Owner-approved simulated conditions, to ensure proper system response and to determine that lighting levels are within specified requirements.
4) Test the system for the different pre-determined settings. Quiet time, AV mode, and normal standard class operation.

e. Lighting Power Density: Perform the test with interior lighting turned on and any manual or automatic controls temporarily overridden. The lighting power shall be measured at the building's electrical panels. Measurements shall be taken at least one minute after lighting in the building is on.
f. Emergency Lighting System: Verify that the system operates automatically under any condition, without human intervention, and that it resets back to normal operations after the power failure is over or cleared.

5. Acceptance Criteria:
a. Lighting Controls: For the conditions, sequences and modes tested, the dimming, occupancy, photocell, and timing controls, integral components and related equipment respond to changing conditions and parameters appropriately as defined in the Contract Documents.
b. Illumination Levels: Average light levels in the tested space at the work plane elevation shall not be less than ten percent below nor greater than 20 percent above the specified light level range for the space.
c. Lighting Power Density: Average instantaneous lighting power density is plus or minus ten percent of that indicated in the Construction Documents. Power factors on lighting circuits shall be 0.95, or as required by lighting fixture specifications.

6. Sampling Strategy for Identical Units:
a. Lighting Controls: Test automatic interior lighting controls.
b. Illumination Levels: At least 50 percent of space zones and rooms, chosen by the Owner, shall be verified as realizing proper light levels. If 25 percent of the spaces in the first sample fail the Functional Performance Tests, test another ten percent of the untested space zones and rooms (the second sample). If ten percent of the spaces in the second sample fail, test remaining spaces.
c. Power Density: Test lighting circuits.

D. Participate and perform Cx related testing requirements prescribed under Sections 01 9113 and the approved project Cx Plan.

3.4 ADJUSTING

A. Systems improperly adjusted, incorrectly installed equipment or deficient Contractor performance may result in additional work being required for Cx acceptance.
1. Perform work required to correct installations not meeting contract requirements at no additional cost to the Owner.

B. Corrective work shall be completed in a timely manner to permit completion of the Cx process.

1. Refer to the Cx Plan for retesting requirements necessary to achieve required system performance.
2. If the systems' Cx deadline, as defined in the Cx Plan, goes beyond the scheduled completion of Commissioning without resolution of the problem, the Owner reserves the right to obtain supplementary services or equipment to resolve the problem.

3.5 TRAINING

A. Provide training and documentation as required in applicable Division 26 specification sections, and other related sections.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
1. Division 26, Section 260150, “Operation and Maintenance of Lighting”.
2. Division 26, Section 260519, “Low Voltage Electrical Power Conductor and Cables”.
3. Division 26, Section 260553, “Identification for Electrical Systems”.
4. Division 26, Section 260800, “Commissioning of Electrical Systems”.
5. Division 26, Section 262726, “Wiring Devices”, (for wall-box dimmers, wall switch occupancy sensors, and manual light switches).
6. Division 26, Section 265100, “Interior Lighting”.
7. Division 26, Section 265600, “Exterior Lighting”.

1.2 SUMMARY

A. This Section includes the following lighting control devices:
1. Time switches.
2. Outdoor and indoor photoelectric switches.
3. Indoor occupancy sensors.
4. Outdoor motion sensors.
5. Lighting contactors.
6. Emergency shunt relays.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.
1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in California Electrical Code (CEC), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Products shall be certified by the manufacturer as compliant with California CCR Title 24.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls; a Genlyte Company.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Paragon Electric Co.; Invensys Climate Controls.
8. Square D; Schneider Electric.
9. TORK.
10. Touch-Plate, Inc.
11. Watt Stopper (The).

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
1. Contact Configuration: SPST, DPST, or DPDT as indicated on drawings.
2. Contact Rating: 20-A ballast load, 120 V or 277 V ac.
3. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week, and an annual holiday schedule that overrides the weekly operation on holidays.
4. Programs: All channels; each channel shall be individually programmable with 2 on-off set points on a 24-hour schedule with skip-a-day weekly schedule.
5. Programs: All channels; each channel shall be individually programmable with 40 on-off operations per week, plus 4 seasonal schedules that modify the basic program, and an annual holiday schedule that overrides the weekly operation on holidays.

6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
7. Astronomic Time: All channels.
8. Battery Backup: For schedules and time clock.

C. Electromechanical-Dial Time Switches: Type complying with UL 917.
1. Contact Configuration: SPST, DPST, SPDT, or DPDT as indicated on drawings.
2. Contact Rating: 20-A ballast load, 120 V or 277 V ac.
3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
4. Astronomic time dial.
5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
6. Skip-a-day mode.
7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Touch-Plate, Inc.
10. Watt Stopper (The).

B. Description: Solid state, with SPST, or DPST dry contacts rated for 1800-VA tungsten, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 15fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

C. Description: Solid state, with SPST, or DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
1. Light-Level Monitoring Range: 1.5 to 15 fc, with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 30-second minimum, to prevent false operation.
3. Lightning Arrester: Air-gap type.

4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 INDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Allen-Bradley/Rockwell Automation.
   2. Area Lighting Research, Inc.; Tyco Electronics.
   3. Eaton Electrical Inc; Cutler-Hammer Products.
   4. Grasslin Controls Corporation; a GE Industrial Systems Company.
   5. Intermatic, Inc.
   6. Lithonia Lighting; Acuity Lighting Group, Inc.
   7. MicroLite Lighting Control Systems.
   8. Novitas, Inc.
   9. Paragon Electric Co.; Invensys Climate Controls.
   10. Square D; Schneider Electric.
   11. TORK.
   12. Touch-Plate, Inc.
   13. Watt Stopper (The).

B. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit mounted on luminaire, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photo-resistors are not acceptable.
   1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   2. Relay Unit: Dry contacts rated for 20 A ballast load at 120- and 277-V ac, for 13 A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by CEC.
   3. Light-Level Monitoring Range: 10 to 200 fc, with an adjustment for turn-on and turn-off levels within that range.
   4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with dead-band adjustment.
   5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

C. Skylight Photoelectric Sensors: Solid-state, light-level sensor; housed in a threaded, plastic fitting for mounting under skylight, facing up at skylight; with separate relay unit mounted on luminaire, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photo-resistors are not acceptable.
   1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   2. Relay Unit: Dry contacts rated for 20 A ballast load at 120- and 277-V ac, for 13 A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by CEC.
   3. Light-Level Monitoring Range: 1000 to 10,000 fc, with an adjustment for turn-on and turn-off levels within that range.
   4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with dead-band adjustment.
   5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.4 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hubbell Lighting.
   2. Leviton Mfg. Company Inc.
   3. Lithonia Lighting; Acuity Lighting Group, Inc.
   4. Novitas, Inc.
   5. RAB Lighting, Inc.
   6. Sensor Switch, Inc.
   7. TORK.
   8. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
   1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by CEC.
   4. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
      c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
   6. Bypass Switch: Override the on function in case of sensor failure.
   7. Automatic Light-Level Sensor: Adjustable from 10 to 200 fc; keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
   1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
   2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
   3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

D. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
   1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
4. Time delay: User selectable as automatic, or as fixed manual setting with selectable range of 5 to 30 minutes.
5. Indicators: LEDs, to show when motion is being detected by each sensor type during testing and normal operation of the sensor

2.5 OUTDOOR MOTION SENSORS (PIR)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bryant Electric; a Hubbell Company.
2. Hubbell Lighting.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Paragon Electric Co.; Invensys Climate Controls.
5. RAB Lighting, Inc.
6. TORK.
7. Watt Stopper (The).

B. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as rain-tight according to UL 773A.
1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Mounting:
a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
3. Bypass Switch: Override the “on” function in case of sensor failure.
4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc; keep lighting off during daylight hours.

C. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.

D. Detection Coverage: Up to 35 feet, with a field of view of 180 degrees, or Up to 52.5 feet, with a field of view of 270 degrees.

E. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.

F. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by CEC.
2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.6 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Electrical Inc.; Cutler-Hammer Products.
4. GE Industrial Systems; Total Lighting Control.
5. Grasslin Controls Corporation; a GE Industrial Systems Company.
6. Hubbell Lighting.
7. Lithonia Lighting; Acuity Lighting Group, Inc.
8. MicroLite Lighting Control Systems.
9. Square D; Schneider Electric.
10. TORK.
11. Touch-Plate, Inc.
12. Watt Stopper (The).

B. Description: Electrically operated and electrically held, combination type with fusible disconnect switch, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.7 EMERGENCY SHUNT RELAY

A. Subject to compliance with requirements, provide products by one of the following:
1. Lighting Control and Design, Inc.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
1. Coil Rating: 120 V or 277 V.

2.8 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519, "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519, "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519, "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519, "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non power-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553, “Identification for Electrical Systems”.
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work. Such devices shall be replaced and re-tested.

C. Perform Title 24, Part 6 California Energy Code Acceptance Tests. Submit typewritten acceptance forms to Architect and DSA inspector.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Section 260943, “Network Lighting Controls”.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01, Section 017900, “Demonstration and Training”.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 and 27 Specification Sections, apply to this Section.

B. Related Sections include the following:
1. Division 26, Section 260519, “Low Voltage Electrical Power Conductors and Cables”.
2. Division 26, Section 260526, “Grounding and Bonding for Electrical Systems”.
3. Division 26, Section 260533, “Raceway and Boxes for Electrical Systems”.
4. Division 26, Section 260553, “Identification for Electrical Systems”.
5. Division 26, Section 260923, “Lighting Control Devices".

1.2 SUMMARY

A. This Section includes the following:
1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Wall-box motion sensors.
4. Isolated-ground receptacles.
5. Snap switches and wall-box dimmers.
6. Wall-switch and exterior occupancy sensors.
7. Pendant cord-connector devices.
8. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 CODES, STANDARDS AND REFERENCES

A. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

B. National Electrical Contractors Association (NECA) - NECA 1: Good Workmanship in Electrical Construction.

C. National Electrical Manufacturers Association – NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

D. National Electrical Manufacturers Association – NEMA FB 11: Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations.

E. National Electrical Manufacturers Association – NEMA WD1: General Color Requirements for Wiring Devices.

F. National Electrical Manufacturers Association – NEMA WD6: Wiring Devices - Dimensional Requirements.

G. Underwriters Laboratories – UL20: General-Use Snap Switches.

H. Underwriters Laboratories – UL436: Outlet Circuit Testers and Similar Indicating Devices.

I. Underwriters Laboratories – UL498: Attachment Plugs and Receptacles.

J. Underwriters Laboratories – UL943: Ground Fault Circuit-Interrupters.

K. Underwriters Laboratories – UL1010: Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.

L. Underwriters Laboratories – UL1436: Outlet Circuit Testers and Similar Indicating Devices.

M. Underwriters Laboratories – UL1472: Solid-State Dimming Controls.

N. Underwriters Laboratories – UL1917: Standard for Solid-State Fan Speed Controls.

1.4 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified, when requested by Architect.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with CEC.

1.7 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.8 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Service/Power Poles: One for every 10, but no fewer than one.
   2. Floor Service Outlet Assemblies: One for every 10 but no fewer than one.
   3. Poke-Through, Fire-Rated Closure Plugs: One for every 5 floor service outlets installed, but no fewer than two.
   4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).
   4. Pass and Seymour/Legrand; Wiring Devices and Accessories (Pass and Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 5351 (single), 5352 (duplex).
      b. Hubbell; HBL5351 (single), CR5352 (duplex).
      c. Leviton; 5891 (single), 5352 (duplex).
      d. Pass and Seymour; 5381 (single), 5352 (duplex).

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; CR 5253IG.
      b. Leviton; 5362-IG.
      c. Pass and Seymour; IG6300.
   2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; TR8300.
      b. Hubbell; HBL8300SG.
      c. Leviton; 8300-SGG.
      d. Pass and Seymour; 63H.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; GF20.
      b. Pass and Seymour; 2084.

2.4 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cooper Crouse-Hinds.
      b. EGS/Appleton Electric.
      c. Killark; a division of Hubbell Inc.

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; L520R.
      b. Hubbell; HBL2310.
      c. Leviton; 2310.
      d. Pass and Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell; IG2310.
   b. Leviton; 2310-IG.
2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

C. Single Equipment Receptacles: Comply with NEMA WD 1, NEMA WD 6 and UL 498.
1. 125 V, 30 A: NEMA L5-30R
2. 208 V, 1 phase, 30 A: NEMA L6-30R

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
   b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
   c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   d. Pass and Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221PL for 120 V and 277 V.
   b. Hubbell; HPL1221PL for 120 V and 277 V.
   c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
   d. Pass and Seymour; PS20AC1-PLR for 120 V.
2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221L.
   b. Hubbell; HBL1221L.

c. Leviton; 1221-2L.
d. Pass and Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass and Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; with factory-supplied key in lieu of switch handle.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper; 1995L.
b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass and Seymour; 1251L.

2.8 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
1. Capacity as indicated; dimmers shall require no derating when ganged with other devices.

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 5 percent of full brightness.

2.9 FAN SPEED CONTROLS

A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
1. Three-speed adjustable, rotary knob, 5 A.

2.10 OCCUPANCY SENSORS

A. Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper; 6111 for 120 V, 6117 for 277 V.
b. Hubbell; WS1277.
c. Leviton; ODS 10-ID.
d. Pass and Seymour; WS3000.
e. Watt Stopper (The); PW-100.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft., selectable automatic or manual ON. Provide dual relay model where dual level switching is indicated on plans.

B. Long-Range Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Hubbell; ATD1600WRP.
b. Leviton; ODW12-MRW.
c. Watt Stopper (The); DT-200 (wall), DT-300 (ceiling).
2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 24 V, adjustable time delay up to 30 minutes, 110-degree field of view (wall mounted), 360-degree field of view (ceiling mounted), LED motion indicators, 5 year warranty and a minimum coverage area of 1200 sq. ft. (desktop motion).
3. Power Pack: 24VDC, 150mA output, 20A ballast switching capacity, plenum rated, and zero-crossing switching.

C. Exterior Occupancy Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Leviton; PS200-10.
b. Watt Stopper (The); EW-100-120.
2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.11 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch thick, satin-finished stainless steel
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant , die-cast aluminum with lockable cover.

2.12 FLOOR SERVICE FITTINGS

A. Products: Subject to compliance with requirements, provide one of the following:
1. Wiremold RFB series
2. Approved equal.

B. Type: Modular, flush-type dual-service units suitable for wiring method used.

C. Compartments: Barrier separates power from voice and data communication cabling.

D. Service Plate: Die-cast aluminum with satin finish.

E. Power Receptacle: NEMA WD 6 configuration 5-20R, unless otherwise indicated.

F. Voice and Data Communication Outlet: Comply with Division 27 requirements.

2.13 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Pass and Seymour/Legrand; Wiring Devices and Accessories.
   3. Square D/ Schneider Electric.
   4. Thomas and Betts Corporation.
   5. Wiremold Company (The).

B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
   1. Service Outlet Assembly: Flush type with four simplex receptacles and space for four RJ-45 jacks.
   2. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
   3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
   4. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
   5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four 4-pair, Category 5e voice and data communication cables.

2.14 MULTIOUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Wiremold Company (The).

B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Steel with ivory finish.

D. Wire: No. 12 AWG.

E. Receptacle spacing: As noted on drawings.

F. Circuiting: Single or dual circuit, as noted on drawings.

2.15 SERVICE POLES

A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.

1. Poles: Nominal 2.5-inch-square cross section, with height adequate to extend from floor to at least 6-inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
3. Finishes: Manufacturer's standard painted finish and trim combination.
4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.
5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
6. Voice and Data Communication Outlets: Comply with Division 27 requirements.

2.16 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by CEC or device listing.
2. Wiring Devices Connected to Standby or Emergency Power System: Red
3. Isolated-Ground Receptacles: Orange.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:
1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of CEC , Article 300, without pigtails.
4. Existing Conductors:
a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pig tailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
   1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtails that are not less than 6-inches in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
   6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
   7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
   8. Tighten unused terminal screws on the device.
   9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
   1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
   1. Install dimmers within terms of their listing.
   2. Verify that dimmers used for fan speed control are listed for that application.
   3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section 260553 "Identification for Electrical Systems."
   1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Cartridge fuses rated 600 V and less for use in switches, panelboards, switchboards, controllers, and motor control centers.
2. Spare-fuse cabinets.

B. Related sections include the following:
1. Division 26, Section 260120, “Operation and Maintenance of Low Voltage Electrical
2. Distribution”.
3. Division 26, Section 260526, “Grounding and Bonding for Electrical Systems”.

1.3 CODES, STANDARDS, AND REFERENCES

A. ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

B. National Electrical Manufacturers Association (NEMA) – NEMA FU 1: Low Voltage Cartridge Fuses.

1.4 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:
1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01, Section 017823, "Operation and Maintenance Data," include the following:
    a. Let-through current curves for fuses with current-limiting characteristics.
    b. Time-current curves, coordination charts and tables, and related data.
    c. Ambient temperature adjustment information.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in California Electrical Code (CEC), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with CEC.

1.6 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.7 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

B. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.8 EXTRA MATERIALS

A. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Cooper Bussman, Inc.
    2. Edison Fuse Co.; Cooper Industries, Inc.
    3. Ferraz Shawmut, Inc.
    4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, non-renewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.3 SPARE-FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
   1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
   2. Finish: Gray, baked enamel.
   3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
   4. Fuse Pullers: For each size of fuse.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Service Entrance: Class L, time delay (for 600 amps. and above).

B. Feeders: Class RK1, or Class J, time delay (for 1 to 600 amps.).

C. Motor Branch Circuits: Class RK1, or Class CC, time delay.

D. Other Branch Circuits: Class J, or Class RK1, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinets.

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch enclosure.

END OF SECTION

SECTION 26 50 00

LIGHT EMITTING DIODE (LED)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Lighting fixtures, including LED lamps arrangements and drivers.

1.2 DEFINITIONS

A. Exception: The term “driver” is used herein to broadly cover both drivers and power supplies, where applicable.

B. Clarification: The term “LED light source(s)” is used herein in accordance with IES LM-80 to broadly cover LED package(s), module(s), and array(s).

1.3 SUBMITTALS

A. List of Materials: Submit a complete list of materials proposed for this section.

B. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of sockets, size of LED boards and drivers, and complete details of method of fitting suspension and fastening fixtures in place. Provide wiring diagrams for lighting control equipment. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.

C. Photometric calculations: Submit calculations with graphic of luminance levels of work and floor planes.

D. Performance Reports:
   1. Luminaire photometric reports per IESNA LM-79 including: laboratory name, report number, date, luminaire catalog number, luminaire and light source specifications. Report shall contain lumen values in Backlight, Uplight, and Glare (BUG) zones per IESNA TM-15 and roadway type classifications luminous intensity, zonal lumen summary, and iso-footcandle diagrams, as well as documentation that specified standards and tests methods were followed.

E. Certifications:
   1. LM 79 report at T=0 and T=6000 hours with a summary table showing the percent lumen output change and percent input power change.
   2. Provide LM80 test results to demonstrate L70 life after 6000 hours of test.
   3. LM-80 test data for the LEDs at the three temperatures per LM-80. Provide extrapolation data using and exponential decay function to show the output at 50,000 hours. Provide the Ts value from the IESNA LM-79 and where the point fall in relation to the IESNA LM-80 extrapolated data. Interpolate between the LM 80 data for the Ts temperature.

4. Provide safety certification and file number as required for the luminaire family that must be listed, labeled or identified per the California Electrical Code (CEC), Applicable testing bodies are determined by the US Occupational Safety Health administration (OSHA), and include ETL, UL, or another Nationally Recognized Testing Laboratory (NRTL).
5. Report substantiating compliance with IESNA TM-21.

F. Certified Statements:
1. Submit manufacturer's certified statement indicating that the manufacturer has been in the business of fabricating lighting fixtures for outdoor and general area illumination for a minimum of 10 years.
2. Establish compliance with the California Lighting Efficiency and Toxics Reduction Act requirements for the manufacturer to have in place a collection and recycling system of any end-of life general purpose light fixtures generated in the State of California.
3. Submit manufacturer's certified statement indicating that the manufacturer has local service with offices no more than 50 miles from Owner's central offices.
4. Certification of compliance that California Health and Safety Code requirements for products containing substances identified in the California Lighting Efficiency and Toxics Reduction Act shall not exceed the following allowed content in parts per million (ppm):
   a. Lead content > 0.1% or 1000 ppm.
   b. Mercury Content > 0.1% or 1000 ppm.
   c. Cadmium Content > 0.01% or 100 ppm.
   d. Hexavalent Chromium > 0.1% or 1000 ppm.
   e. Polybrominated Biphenyls > 0.1% or 1000 ppm.
   f. Polybrominated Biphenyls Ether > 0.1% or 1000 ppm.

G. Substitutions:
1. Substitutions shall provide an entire lighting calculation package due 10 days after bid date.
2. Substitutions package shall provide a sample of each fixture for review 10 days after bid date.
3. Substitution package shall provide a comparison chart of their product against specified package due 10 days after bid date.
4. Substitution package must provide all necessary documentation stated in 26500 due 10 days after bid date.

H. Installation Instructions: Submit manufacturer's written installation instructions for fixtures and accessories.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: 10 years in the fabrication of lighting fixtures.

B. Listing and Labels: Light fixtures shall be Underwriters Laboratory (UL) or Nationally Recognized Testing Laboratory (NRTL) listed, and in compliance with applicable industry standards and codes. NRTL test laboratories shall be qualified by the DOE and listed in the DOE SSL website.

C. Design of lighting fixtures, accessories, supports, and method of fixture installation shall comply with requirements for earthquake-resistant construction of the State of California.

1.5 WARRANTY

A. Five years on-site replacement material, fixture finish and workmanship. On-site replacement includes transportation, removal, and installation of new products. Finish warranty shall include warranty against failure or substantial deterioration such as blistering, cracking, peeling, chalking or fading.

B. Five years material replacement warranty for defective or non-starting LED source assemblies, drivers, and power supply units (PSU).

PART 2 - PERFORMANCE REQUIREMENTS

2.1 Performance Requirements

A. Wiring cavity shall be field accessible for service or repairs.

B. Provide a minimum 6,000 hours of integral lamp operating data (not just LED data) and documented projection for 50,000 operating hours. Testing procedures and results documentation shall comply with the Department of Energy LED Luminaire Lifetime Recommendations for Testing and Reporting 1st Edition.

C. Color Rendering Index shall not be less than 70 for exterior and not less than 80 for interior.

D. Lighting fixtures shall have a minimum luminaire efficiency rating (LER) equal or greater than 75, and an Initial Lumen Efficacy (ILE) equal or greater than 70. Unless otherwise noted on the schedule.

E. The acceptable Correlated Color Temperature (CCT) shall be 4000 degrees K +/- 500 degrees K unless otherwise noted on fixture schedule.

F. Lumen Maintenance (LM) at 6000 hrs must be greater or equal to 95%. Provide tests reports and photometric data.

G. Projected Lumen Maintenance (LM) at 50000 hrs greater or equal to 90%.

H. The Power Factor (PW) shall not be less than 0.90.

I. The Total harmonic Distortion (THD) shall be less than 20%.

J. Fixtures shall operate on 120, 208, 240, 277, or 480 Volts in compliance with the requirements set forth in ANSI standard C136.15.

K. Power supply shall have a Class A sound rating in compliance with the requirements set forth in ANSI standard C136.15.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Drivers and LED boards shall be permanently labeled with the day of installation with one-inch high letters produced with a P-touch or similar permanent labeling system.

B. Installations shall comply with CBC Seismic requirements, California Electrical code and applicable ordinances and industry standards.

C. Emergency light fixtures shall be labeled “Emergency Fixture” with one-inch high letters produced with a P-touch or similar permanent labeling system.

3.2 TESTING

A. Check and adjust fixtures for required illumination.

B. Replace defective drivers and LED boards.

C. Test and adjust lighting control equipment for proper operation.

3.3 SPARE PARTS

A. Furnish ten percent spare drivers with a minimum of one spare LED board of each type.

B. Furnish five percent spare motion detectors of each type with a minimum of one spare detector of each type.

3.4 HAZARDOUS WASTE DISPOSAL

A. Hazardous waste disposals shall be handled and disposed of by licensed contractor.

B. Store, remove, transport and dispose of hazardous materials in all accordance with state and federal regulations.

C. Provide Owner with copy of manifest and certificate of destruction.

3.5 PROTECTION

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

3.6 CLEANUP

A. Remove rubbish, debris, and waste materials from all areas of work each day.

B. Clean fixture surfaces of dirt, cement, plaster and debris. Furnish cleansers compatible with material surfaces being cleaned.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 01and 23 Specification Sections, apply to this Section.

B. Related Sections include the following:
1. Division 26, Section 260150, “Operation and Maintenance of Lighting”.
2. Division 26, Section 260519, “Low Voltage Electrical Power Conductors and Cables”.
3. Division 26, Section 260526, “Grounding and Bonding for Electrical Systems”.
4. Division 26, Section 260529, “Hangers and Supports for Electrical Systems”.
5. Division 26, Section 260548, “Vibration and Seismic Controls for Electrical Systems”.
6. Division 26, Section 260553, “Identification for Electrical Systems”.
7. Division 26, Section 260923, “Lighting Control Devices", (for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multi-pole lighting relays and contactors).
8. Division 26, Section 262726, "Wiring Devices", (for manual wall-box dimmers for incandescent lamps).

1.2 SUMMARY

A. This Section includes the following:
1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for fluorescent lighting fixtures.

1.3 CODES, STANDARDS, AND REFERENCES

A. ANSI C78.42: American National Standard for Electric Lamps - Guidelines for High-Pressure Sodium Lamps.

B. ANSI C82.1: American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast.

C. ANSI C82.11: High Frequency Fluorescent Lamp Ballast.

D. ANSI/IEEE C62.41: Guide for Surge Voltages in Low-Voltage AC Power Circuits.

E. ANSI/NFPA 70: National Electrical Code, with California amendments (CEC).

F. ANSI/NFPA 101: Life Safety Code.

G. ASTM A580/A580M: Standard Specification for Stainless Steel Wire.

H. ASTM A641/A641M: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

I. California Code of Regulations (CCR) Title 24, Part 2: California Building Code (CBC).

J. California Code of Regulations (CCR): Title 24, Part 6 California Energy Code

K. Code of Federal Regulations (CFR) 14 CFR 15: Title 47 – Telecommunication, Part 18 – Industrial, Scientific, and Medical Equipment.

L. MIL-STD-461E: DOD Interface Standard - Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment.

M. National Electrical Manufacturers Association (NEMA) – NEMA LE4: Recessed Luminaires, Ceiling Compatibility.

N. National Electrical Manufacturers Association (NEMA) – NEMA LE5: Procedure for Determining Luminaire Efficacy Ratings for Fluorescent Luminaires.

O. National Electrical Manufacturers Association (NEMA) – NEMA LE5A: Procedure for Determining Luminaire Efficacy Ratings for Commercial, Non-Residential Downlight Luminaires.

P. National Electrical Manufacturers Association (NEMA) – NEMA LE5B: Procedure for Determining Luminaire Efficacy Ratings for High-Intensity Discharge Industrial Luminaires.

Q. National Electrical Manufacturers Association (NEMA) – NEMA LL 1: Procedure For Linear Fluorescent Lamp Sample Preparation and the TCLP Extraction.

R. Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

S. Underwriters Laboratories - UL 486A: Wire Connectors

T. Underwriters Laboratories - UL 924: Emergency Lighting and Power Equipment.

U. Underwriters Laboratories - UL 1598: Luminaires.

1.4 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.5 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
   2. Emergency lighting units including battery and charger.
   3. Ballast, including input voltage, watts, volt-amperes, power factor and ballast factor.
   4. Energy-efficiency data.
   5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article, in Division 23, Section 233713, "Diffusers, Registers, and Grilles".
   6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23, Section 233713, "Diffusers, Registers, and Grilles".
   7. Life, output, and energy-efficiency data for lamps.
   8. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
      a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
      b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
   1. Wiring Diagrams: Power and control wiring.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Lighting fixtures.
   2. Suspended ceiling components.
   3. Structural members to which suspension systems for lighting fixtures will be attached.
   4. Other items in finished ceiling, including the following:
      a. Air outlets and inlets.
      b. Speakers.
      c. Sprinklers.

d. Smoke and fire detectors.
e. Occupancy sensors.
f. Access panels.

1. Perimeter moldings.

D. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:
1. Lamps: Specified units installed.
2. Accessories: Cords and plugs.
3. Ballasts: 120 V or 277 V model of specified ballast type.

E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer, certifying that products comply with all specified requirements (including non-interference with hearing aids).

F. Qualification Data: For agencies providing photometric data for lighting fixtures.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals, per requirements of Division 1, Section 017823.

I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with CEC.

D. Comply with visibility and luminance requirements for exit signs per NFPA 101.

E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.
1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive the District of other rights District may have under other provisions of the Contract Documents and State of California Contract Law, and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
   2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

C. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
   2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.

D. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: Two years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Battery and Charger Data: One for each emergency lighting unit.
   4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that 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.

B. Refer to Section 26 05 53 Part 3 for equipment identification labels and lighting fixture schedule on drawings.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 94 percent.
   3. Diffusing Specular Surfaces: 75 percent.
   4. Laminated Silver Metallized Film: 90 percent.

I. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
   b. UV stabilized.
2. Glass: Annealed crystal glass, unless otherwise indicated.

J. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

K. Not used

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Programmed-Start Ballasts for T8 Lamps: Comply with ANSI C82.11; programmed rapid-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
   1. Sound Rating: A.
   2. Total Harmonic Distortion Rating: Less than 10 percent.
   3. Transient Voltage Protection: IEEE C62.41, Category A or better.
   4. Operating Frequency: 20 kHz or higher.
   5. Lamp Current Crest Factor: 1.7 or less.
   6. BF: 0.87 or higher.
   7. Power Factor: 0.98 or higher.
   8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:
   1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
   2. Automatic lamp starting after lamp replacement.
   3. Sound Rating: A.
   4. Total Harmonic Distortion Rating: Less than 20 percent.
   5. Transient Voltage Protection: IEEE C62.41, Category A or better.
   6. Operating Frequency: 20 kHz or higher.
   7. Lamp Current Crest Factor: 1.7 or less.
   8. BF: 0.95 or higher, unless otherwise indicated.

9. Power Factor: 0.98 or higher.

C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
   1. Ballast Manufacturer Certification: Indicated by label.

D. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

E. Ballasts for Low-Temperature Environments:
   1. Temperatures 0 Deg F and Higher: Electronic or electromagnetic type rated for 0 deg F starting and operating temperature, with indicated lamp types.

F. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
   1. Dimming Range: 100 to 1 or 5 percent of rated lamp lumens as noted.
   2. Ballast Input Watts: Can be reduced to 20 percent of normal.
   3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

H. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
   1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
      a. High-Level Operation: 100 percent of rated lamp lumens.
      b. Low-Level Operation: 30 percent of rated lamp lumens.
   2. Ballast shall provide equal current to each lamp in each operating mode.
   3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic, programmed, rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
   1. Lamp end-of-life detection and shutdown circuit.
   2. Automatic lamp starting after lamp replacement.
   3. Sound Rating: A.
   4. Total Harmonic Distortion Rating: Less than 20 percent.
   5. Transient Voltage Protection: IEEE C62.41, Category A or better.
   6. Operating Frequency: 20 kHz or higher.
   7. Lamp Current Crest Factor: 1.7 or less.
   8. BF: 0.95 or higher, unless otherwise indicated.
   9. Power Factor: 0.98 or higher.
   10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

11. Ballast Case Temperature: 75 deg C, maximum.

B. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
   1. Dimming Range: 100 to 1 or 5 percent of rated lamp lumens as noted.
   2. Ballast Input Watts: Can be reduced to 20 percent of normal.
   3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
   1. Emergency Connection: Operate one or two 48 inch T8 fluorescent lamp(s) continuously at a total output of 3000 lumens. Connect un-switched circuit to battery-inverter ballast and switched circuit to fixture ballast.
   2. Night-Light Connection: Operate one fluorescent lamp continuously.
   3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
      a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   4. Battery: Sealed, maintenance-free, nickel-cadmium type.
   5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay, self-diagnostic and self-testing.
   6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.6 BALLASTS FOR HID LAMPS

A. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
   1. Lamp end-of-life detection and shutdown circuit.
   2. Sound Rating: A.
   3. Total Harmonic Distortion Rating: Less than 15 percent.
   4. Transient Voltage Protection: IEEE C62.41, Category A or better.
   5. Lamp Current Crest Factor: 1.5 or less.
   6. Power Factor: 0.98 or higher.
   7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
   8. Protection: Class P thermal cutout.
   9. Retain subparagraph and associated subparagraphs below for bi-level ballasts.
   10. Bi-Level Dimming Ballast: Ballast circuit and leads provide for remote control of the light output of the associated fixture between high- and low-level and off.

a. High-Level Operation: 100 percent of rated lamp lumens.
b. Low-Level Operation: 35 percent of rated lamp lumens.
c. Compatibility: Certified by ballast manufacturer for use with specific bi-level control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.

11. Continuous Dimming Ballast: Dimming range shall be from 100 to 35 percent of rated lamp lumens without flicker.
    a. Ballast Input Watts: Reduced to a maximum of 50 percent of normal at lowest dimming setting.
    b. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.

B. Auxiliary Instant-On Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.

C. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter-starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
1. Instant Re-strike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
    a. Re-strike Range: 105- to 130-V ac.
    b. Maximum Voltage: 250-V peak or 150-V ac RMS.
2. Minimum Starting Temperature: Minus 40 deg F.
3. Open-circuit operation shall not reduce average lamp life.

2.7 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay and self-diagnostic.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
h. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
i. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.8 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.
1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay and self-diagnostic.
3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.9 FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T8, rapid-start, low-mercury, lamps, rated 32 W maximum, nominal length of 48 inches, 3000 initial lumens (minimum), CRI 75 (minimum), color temperature 5000 K, and average rated life 30,000 hours, unless otherwise indicated.

C. T8, rapid-start, low-mercury, lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 5000 K, and average rated life of 30,000 hours, unless otherwise indicated.

D. T5, rapid-start, low-mercury, lamps, rated 28 W maximum, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 5000 K, and average rated life of 20,000 hours, unless otherwise indicated.

E. T5HO, rapid-start, high-output, low-mercury, lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 5000 K, and average rated life of 20,000 hours, unless otherwise indicated.

F. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 5000 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.
   1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
   2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
   3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
   4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
   5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
   6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

2.10 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 2100 K, and average rated life of 24,000 hours, minimum.
   1. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

B. Metal-Halide Lamps: minimum CRI 65, color temperature 4000 K and average rated life of 20,000 hours, minimum.

C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K and average rated life of 20,000 hours, minimum..

D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K and average rated life of 20,000 hours, minimum.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529, "Hangers and Supports for Electrical Systems", for channel- and angle-, iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 AWG, or as indicated on drawings.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 AWG, or as indicated on drawings.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.12 RETROFIT KITS FOR FLUORESCENT LIGHTING FIXTURES

A. Comply with UL 1598 listing requirements.
   1. Reflector Kit: UL 1598, Type I. Suitable for two- to four-lamp, surface-mounted or recessed lighting fixtures by improving reflectivity of fixture surfaces.
   2. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

2.13 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

A. Fixture Type: Commercial full-size fluorescent. (Lamps exceeding 48” in length shall not be permitted).
   1. Available Manufacturers:
      a. Lithonia.
      b. Day-Brite.
      c. Lightolier.
      d. Metalux.
      e. Hubbell.
      f. Finelite.
   2. Voltage: 120 volts or 277 volts ac.
   3. Mounting: Recessed ceiling, Semi-recessed, Pendant, Surface ceiling, Suspended. Mounting height of pendant, wall, or suspended fixture shall be as indicated on drawings.
   4. Nominal Dimensions: As indicated and specified.
   5. Lamps: Number a type as indicated.
   6. Ballast Type: Electronic instant start, Electronic dimming, Electronic bi-level, or Electromagnetic.
   7. BF: 0.87 – 0.90.
   8. Quantity of Ballasts per Fixture: As indicated and specified.
   9. Ballast Type: Electronic, Electronic continuous dimming, Electronic bi-level dimming, Electromagnetic, compatible with lamp type indicated.
   10. Ballast Fuse: Factory installed, slow-blow type rated between 2.65 and 3.0 times the line current.

11. Lens: Translucent white or clear as indicated and specified.
12. External Finish: High gloss white polyester paint.
13. Trim and Hardware: Spring-loaded door latches.
14. Special Environmental Conditions: Corrosive, damp, or wet locations as indicated on drawings.
15. Minimum CU for typical RCR shall be as follows (typical cavity reflectances are ceiling, 80 percent; wall, 50 percent; and floor, 20 percent):
    a. RCR 3: 0.76 CU.
    b. RCR 5: 0.62 CU.
    c. RCR 7: 0.51 CU.
16. Minimum Spacing to Mounting Height Ratio: 1.4.
17. Minimum Visual Comfort Probability (VCP): 70, for room dimensions as specified on drawings.
18. Maximum Luminance Ratio: 5.
19. Minimum LER: 70.
20. Submit Sample.
21. Provide lighting fixtures as needed for mockups.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
   1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
   2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
   3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
   4. Install at least two independent support rods or wires from structure to a tab on lighting fixture. Wires or rods shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support shall be per approved structural plans:
   1. All suspended or stem-mounted fixture supports for fixtures weighing 20 lbs. or greater shall be designed to resist total design seismic forces prescribed in Section 1613, (1613A for Public Schools), of the California Building Code, and per requirements of Section 260548, "Vibration and Seismic Controls for Electrical Systems".
   2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   3. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
   4. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

5. Continuous Rows: Use aircraft cable with coiled white cable at fixture branch circuit feed point and additional aircraft cable suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Section 260519, "Low-Voltage Electrical Power Conductors and Cables".

3.2 CONNECTIONS

A. Ground Equipment.
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

C. Furnish original and four copies of the complete report to the Architect in accordance with requirements of Contract Documents.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
1. Division 26, Section 260120, “Operation and Maintenance of Low Voltage Electrical Distribution”.
2. Division 26, Section 260150, “Operation and Maintenance of Lighting”.
3. Division 26, Section 260500, “Common Work Results for Electrical”.
4. Division 26, Section 260519, “Low Voltage Electrical Power Conductors and Cables”.
5. Division 26, Section 260526, “Grounding and Bonding for Electrical Systems”.
6. Division 26, Section 260543, “Underground Ducts and Raceways for Electrical Systems”.
7. Division 26, Section 260548, “Vibration and Seismic Controls for Electrical Systems”.
8. Division 26, Section 260553, “Identification for Electrical Systems”.
9. Division 26, Section 260923, “Lighting Control Devices”.
10. Division 26, Section 265100, “Interior Lighting”, for exterior luminaries normally mounted on exterior surfaces of buildings.
11. Division 26, Section 265629, “Site Lighting”.

1.2 SUMMARY

A. This Section includes the following:
1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.

1.3 CODES, STANDARDS, AND REFERENCES

A. American National Standards Institute (ANSI) – ANSI C78.42: American National Standard for Electric Lamps - Guidelines for High-Pressure Sodium Lamps.

B. American National Standards Institute (ANSI) – ANSI C82.1: American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast.

C. American National Standards Institute (ANSI) – ANSI C82.4: American National Standard for Lamp Ballasts - Ballasts for High-Intensity Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

D. American National Standards Institute (ANSI) – ANSI C136.10: American National Standard for Roadway and Area Lighting Equipment - Locking-type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing.

E. American National Standards Institute (ANSI) – ANSI/IESNA RP-8: American National Standard Practice for Roadway Lighting.

F. ANSI/IEEE C2: National Electrical Safety Code (NESC).

G. ANSI/IEEE C62.41: Guide for Surge Voltages in Low-Voltage AC Power Circuits.

H. ANSI/NFPA 70 – National Electrical Code, with California amendments (CEC).

I. California Code of Regulations (CCR) Title 24, Part 6 California Energy Code.

J. National Association of Corrosion Engineers (NACE) - NACE No. 1 - SSPC SP5: Joint Surface Preparation Standard: White Metal Blast Cleaning.

K. NAAMM: Metal Finishes Manual for Architectural and Metal Products.

L. National Electrical Manufacturers Association (NEMA) – NEMA LL 1: Procedure For Linear Fluorescent Lamp Sample Preparation and the TCLP Extraction.

M. Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

N. The Society for Protective Coatings (SSPC) - SP1: Solvent Cleaning.

O. The Society for Protective Coatings (SSPC) - SP8: Pickling.

P. Underwriters Laboratories – UL 773: Plug-In Locking Type Photocontrols for Use with Area Lighting.

Q. Underwriters Laboratories – UL 773A: Non-Industrial Photoelectric Switches for Lighting Control.

R. Underwriters Laboratories – UL 1029: High-Intensity-Discharge Lamp Ballasts Product Categories.

S. Underwriters Laboratories – UL 1598: Luminaires.

1.4 DEFINITIONS

A. CRI: Color-rendering index.

B. HID: High-intensity discharge.

C. Luminaire: Complete lighting fixture, including ballast housing, if provided.

1.5 SUBMITTALS

A. Product Data: For each luminaire and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of luminaire, including materials, dimensions and verification of indicated parameters.
   2. Details of attaching luminaires and accessories.
   3. Details of installation and construction.
   4. Luminaire materials.
   5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
      a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
      b. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
   6. Photoelectric relays.
   7. Ballasts, including energy-efficiency data.
   8. Lamps, including life, output, and energy-efficiency data.
   9. Materials, dimensions, and finishes of poles.
   10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.

B. Shop Drawings:
   1. Wiring Diagrams: Power and control wiring.

C. Samples for Verification: For products designated for sample submission in Section 260600, “Schedules for Electrical” Lighting Fixture Schedule. Each sample shall include lamps and ballasts.

D. Qualification Data: For agencies providing photometric data for lighting fixtures.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For luminaries, to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ANSI/IEEE C2.

E. Comply with CEC.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
   1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
   2. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
   4. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles, where titles below introduce lists, the following requirements apply to product selection:

B. In Lighting Fixture Schedule, where titles below are column or row headings that 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 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products", for recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove

mill scale and rust, if present, from uncoated steel, complying with NACE No. 1 - SSPC SP5, or SSPC SP8, "Pickling".

2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
   a. Color: As selected from manufacturer's standard catalog of colors.
   b. Color: Match Architect's sample of manufacturer's standard or custom color.
   c. Color: As selected by Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products", for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.1 mil or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.1 mil or thicker) complying with AAMA 611.
   a. Color: As specified in Lighting Fixture Schedule on drawings.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 FLUORESCENT BALLASTS AND LAMPS

A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamps at temperatures minus 20 deg F and higher.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: A.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
6. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures minus 20 deg F and higher.

D. Fluorescent Lamps: Low-mercury type. Comply with the EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

2.5 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated:
   1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
   2. Minimum Starting Temperature: Minus 22 deg F.
   3. Normal Ambient Operating Temperature: 104 deg F.
   4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.

C. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
   1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
      a. Restrike Range: 105- to 130-V ac.
      b. Maximum Voltage: 250-V peak or 150-V ac RMS.
   2. Minimum Starting Temperature: Minus 40 deg F.

2.6 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
   1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

B. Metal-Halide Lamps: minimum CRI 65, and color temperature 4000 K.

C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.
   1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.2 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533, "Raceway and Boxes for Electrical Systems". In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
   1. Verify operation of photoelectric controls.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

D. Furnish original and four copies of the complete report to the Architect in accordance with requirements of Contract Documents.

END OF SECTION

SECTION 26 56 29

SITE LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 01, and 03 Specification Sections, apply to this Section.

B. Related Sections include the following:
1. Division 26, Section 260120, “Operation and Maintenance of Low Voltage Electrical Distribution”.
2. Division 26, Section 260150, “Operation and Maintenance of Lighting”.
3. Division 26, Section 260500, “Common Work Results for Electrical”.
4. Division 26, Section 260519, “Low Voltage Electrical Power Conductors and Cables”.
5. Division 26, Section 260526, “Grounding and Bonding for Electrical Systems”.
6. Division 26, Section 260543, “Underground Ducts and Raceways for Electrical Systems”.
7. Division 26, Section 260548, “Vibration and Seismic Controls for Electrical Systems”.
8. Division 26, Section 260553, “Identification for Electrical Systems”.
9. Division 26, Section 260923, “Lighting Control Devices”.
10. Division 26, Section 265100, “Interior Lighting”, for exterior luminaries normally mounted on exterior surfaces of buildings.
11. Division 26, Section 265600, “Exterior Lighting”.

1.02 SUMMARY

A. This Section includes the following:
1. Exterior area lighting (parking lot) luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.
4. Luminaire lowering devices.

1.03 CODES, STANDARDS AND REFERENCES

A. AA: The Aluminum Association, Inc.

B. AASHTO LTS-4: Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

C. American Architectural Manufacturers Association (AAMA) – AAMA 611: AAMA Architectural Finishes - Clear Anodized.

D. American National Standards Institute (ANSI) – ANSI C78.42: American National Standard for Electric Lamps - Guidelines for High-Pressure Sodium Lamps.

E. American National Standards Institute (ANSI) – ANSI C78.1372: American National Standard for Electric Lamps-70-Watt, M98 Single-Ended Metal-Halide Lamps.

F. American National Standards Institute (ANSI) – ANSI C82.1: American National Standard for Lamp Ballasts - Line Frequency Fluorescent Lamp Ballast.

G. American National Standards Institute (ANSI) – ANSI C82.4: American National Standard for Lamp Ballasts - Ballasts for High-Intensity Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

H. American National Standards Institute (ANSI) – ANSI C136.10: American National Standard for Roadway and Area Lighting Equipment—Locking-type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing.

I. American National Standards Institute (ANSI) – ANSI C136.13: American National Standard for Roadway Lighting - Metal Brackets for Wood Poles.

J. American National Standards Institute (ANSI) – ANSI C136.20: American National Standard for Roadway Lighting Equipment - Fiber-Reinforced Plastic (FRP) Lighting Poles.

K. ANSI/IEEE C2: National Electrical Safety Code (NESC).

L. ANSI/IEEE C62.41: Guide for Surge Voltages in Low-Voltage AC Power Circuits.

M. ANSI/IESNA RP-8: American National Standard Practice for Roadway Lighting.

N. ANSI/NFPA 70 – National Electrical Code, with California amendments (CEC).

O. American Society for Testing and Materials (ASTM) - ASTM A36/A36M: Standard Specification for Carbon Structural Steel.

P. American Society for Testing and Materials (ASTM) - ASTM A48/A48M: Standard Specification for Gray Iron Castings.

Q. American Society for Testing and Materials (ASTM) - ASTM A123/A123M: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

R. American Society for Testing and Materials (ASTM) - ASTM A500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

S. American Society for Testing and Materials (ASTM) - ASTM B660: Standard Practices for Packaging/Packing of Aluminum and Magnesium Products.

T. American Society for Testing and Materials (ASTM) - ASTM C979: Standard Specification for Pigments for Integrally Colored Concrete.

U. California Code of Regulations (CCR) Title 24, Part 6 California Energy Code.

V. IESNA LM-5: IESNA Guide for Photometric Measurements of Area and Sports Lighting Installments.

W. IESNA LM-50: Photometric Measurement of Roadway Lighting Installations.

X. IESNA LM-52: Photometric Measurements of Roadway Sign Installations.

Y. IESNA LM-64: Photometric Measurements of Parking Areas.

Z. IESNA LM-72: Directional Positioning of Photometric Data.

AA. NAAMM: Metal Finishes Manual for Architectural and Metal Products.

BB. National Electrical Manufacturers Association (NEMA) – NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

CC. National Electrical Manufacturers Association (NEMA) – NEMA LL 1: Procedure for Linear Fluorescent Lamp Sample Preparation and the TCLP Extraction.

DD. Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

EE. The Society for Protective Coatings (SSPC): SP 1 Solvent Cleaning.

FF. The Society for Protective Coatings (SSPC): SP 5 / NACE No. 1 White Metal Blast Cleaning.

GG. The Society for Protective Coatings (SSPC): SP 8 Pickling.

HH. Underwriters Laboratories – UL 773: Plug-In Locking Type Photocontrols for Use with Area Lighting.

II. Underwriters Laboratories – UL 773A: Non-Industrial Photoelectric Switches for Lighting Control.

JJ. Underwriters Laboratories – UL 1029: High-Intensity-Discharge Lamp Ballasts Product Categories.

KK. Underwriters Laboratories – UL 1598: Luminaires.

1.04 DEFINITIONS

A. CRI: Color-rendering index.

B. HID: High-intensity discharge.

C. Luminaire: Complete lighting fixture, including ballast housing, if provided.

D. NRTL: Nationally Recognized Testing Laboratory.

E. Pole: Luminaire support structure, including tower used for large area illumination.

F. Standard: Same definition as "Pole" above.

1.05 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.

B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4.

C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4.

D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
   1. Wind speed for calculating wind load for poles exceeding 50 feet in height is 70 mph.
   2. Wind speed for calculating wind load for poles 50 feet or less in height is 110 mph.

1.06 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
   2. Details of attaching luminaires and accessories.
   3. Details of installation and construction.
   4. Luminaire materials.
   5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
      a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
      b. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
   6. Photoelectric relays.
   7. Ballasts, including energy-efficiency data.
   8. Lamps, including life, output, and energy-efficiency data.
   9. Materials, dimensions, and finishes of poles.
   10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
   11. Anchor bolts for poles.
   12. Manufactured pole foundations.

B. Shop Drawings:
   1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
   2. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
   3. Wiring Diagrams: Power and control wiring.

C. Samples for Verification: For products designated for sample submission in Section 260600, “Schedules for Electrical”, Lighting Fixture Schedule. Each sample shall include lamps and ballasts.

D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.

E. Qualification Data: For agencies providing photometric data for lighting fixtures.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For luminaries, poles, and luminaire lowering devices to include in emergency, operation, and maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.07 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ANSI/IEEE C2.

E. Comply with CEC.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
   1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
   2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
   3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
   4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.
   5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
   4. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles, where titles below introduce lists, the following requirements apply to product selection:

B. In Lighting Fixture Schedule, where titles below are column or row headings that 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.

2.02 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products", for recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning", or SSPC-SP 8, "Pickling".
   2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
      a. Color: As selected from manufacturer's standard catalog of colors.
      b. Color: Match Architect's sample of manufacturer's standard or custom color.
      c. Color: As selected by Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products", for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by The Aluminum Association, Inc. for designating aluminum finishes.
   2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
   3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
   4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
      a. Color: as specified in the drawings.

2.03 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
   1. Relay with locking-type receptacle shall comply with ANSI C136.10.
   2. Adjustable window slide for adjusting on-off set points.

2.04 FLUORESCENT BALLASTS AND LAMPS

A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamps at temperatures minus 20 deg F and higher.

B. Ballast Characteristics:
   1. Power Factor: 90 percent, minimum.
   2. Sound Rating: A.
   3. Total Harmonic Distortion Rating: Less than 10 percent.

4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
6. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures minus 20 deg F and higher.

D. Fluorescent Lamps: Low-mercury type. Comply with the EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

2.05 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F.
3. Normal Ambient Operating Temperature: 104 deg F.
4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.

C. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
a. Restrike Range: 105- to 130-V ac.
b. Maximum Voltage: 250-V peak or 150-V ac RMS.
2. Minimum Starting Temperature: Minus 40 deg F.

2.06 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.07 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-4.
   1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
   2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
   1. Materials: Shall not cause galvanic action at contact points.
   2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
   3. Anchor-Bolt Template: Plywood or steel.

D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03, Section 033000, "Cast-in-Place Concrete".

E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

2.08 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; 1-piece construction up to 40 feet in height with access handhole in pole wall.
   1. Shape: Round, tapered; Round, straight; Square, tapered; or Square, straight as indicated on project drawings.
   2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms: Single-arm, Truss, or Davit type, as indicated on project drawings, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without under-brace.
   1. Adapter fitting welded to pole and bracket, then bolted together with stainless steel bolts.
   2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
   3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Intermediate Handhole and Cable Support: Weather-tight, 3-by-5-inch handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.

F. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 260526, "Grounding and Bonding for Electrical Systems", listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

H. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.

I. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

J. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

K. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
   2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
   3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
      a. Color: As selected by Architect from manufacturer's full range.

2.09 FIBERGLASS POLES

A. Poles: Comply with ANSI C136.20, with access handhole in pole wall.

1. Mounting: Embedded.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Resin Color: Dark bronze; provide uniform coloration throughout entire wall thickness.

C. Surface Finish: Pigmented polyurethane, with a minimum dry film thickness of 1.5 mils.

2.10 DECORATIVE POLES

A. Pole Material:
1. Cast ductile iron.
2. Cast gray iron, according to ASTM A 48/A 48M, Class 30.
3. Cast aluminum.
4. Cast concrete.
5. Spun concrete.
6. Steel tube, covered with closed-cell polyurethane foam, with a polyethylene exterior.

B. Mounting Provisions:
1. Bolted to concrete foundation.
2. Embedded.

C. Fixture Brackets:
1. Cast ductile iron.
2. Cast gray iron.
3. Cast aluminum.

D. Pole Finish: As indicated on project drawings.

2.11 PRESTRESSED CONCRETE POLES

A. Poles: Manufactured by centrifugal spin-casting process.
1. Shape: Round, tapered; Round, straight; Square, tapered; or Square, straight as indicated on project drawings.
2. Mounting Provisions: Steel butt flange for bolted mounting to foundation or breakaway support, or Embedded as indicated on drawings.
3. Finishing: Capped at top and plugged at bottom. Seat each steel reinforcing strand with epoxy adhesive.
4. Grounding: Continuous copper ground wire cast into pole. Terminate at top of pole and attach to 24-inch lightning rod.

B. Cure with wet steam and age for a minimum of 15 days before installation.

C. Fabricate poles with a hard, nonporous surface that is resistant to water, frost, and road and soil chemicals and that has a maximum water-absorption rate of 3 percent.

D. Cast aluminum nameplate into pole wall at approximately 5 feet above ground line, listing name of manufacturer, Project identifier, overall height, and approximate weight.

E. Pole Brackets: Comply with ANSI C136.13.

F. Finish Color: Provided by color material complying with ASTM C 979, uniformly impregnated throughout the pole concrete. Color material shall provide a uniform, stable, permanent color and be as follows:
   1. Inert, and carbon free.
   2. Unaffected by environmental conditions and contaminants including, but not limited to, UV solar radiation, salts, and alkalis.

G. Finish Texture: Polished exposed aggregate, or Etched exposed aggregate, as indicated on drawings.
   1. Exposed aggregate shall be of aggregate type, as selected by Architect, from manufacturers' lists.

2.12 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Section 262726, "Wiring Devices", for ground-fault circuit-interrupter type.
   1. Surface mounted or recessed, 12 inches above finished grade.
   2. Non-metallic polycarbonate plastic or reinforced fiberglass cover, color to match pole color, that when mounted results in NEMA 250, Type 4X enclosure.
   3. With cord opening.
   4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.

C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

D. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept ballasts, and indicated accessories.

E. Decorative accessories, supplied by decorative pole manufacturer, include the following:
   1. Banner Arms: Same material and color as pole.
   2. Flag Holders: Same material and color as pole.
   3. Ladder Rests: Same material and color as pole.

F. Threaded hole for 3/4 inch conduit.

2.13 LOWERING SYSTEM FOR LUMINAIRES

A. Arrange system to lower luminaire assembly to a servicing position within 36 inches of finished grade in winds up to 30 mph and to provide for manual plug connection to electrical power in the lowered position for testing.

B. Coordinate with luminaire and pole manufacturers for assembly details, wind-load and vibration analysis, and compatibility of materials for electrolysis-free attachment and

connection for luminaire mounting assembly, lowering device, lowering cable, and portable winch.

C. Structural and Mechanical Design: Use a minimum safety factor of 5.0 for static and dynamic loads of load-bearing components, including cable.

D. Luminaire Mounting and Disconnect Arrangement: Multiple ring, or carriage-mounted luminaires, arranged for lowering and raising as a group.
   1. Electrical cable for normal operating power to luminaires automatically disconnects at a weatherproof multi-pin connector within the pole-top lowering head at the beginning of the lowering cycle and reconnects when luminaire or luminaire assembly is raised to the operating position.

E. Lowering Device: Weatherproof, cast-aluminum housing and multiple mechanical latches. Moving parts of latching assembly shall be located in the portion of the unit that is lowered to the servicing position. Positive latching in the operating position shall be indicated to the operator at the base of the pole by a clear visual signal, or by other means acceptable to Owner or authorities having jurisdiction.

F. Lowering Cable: Stainless steel aircraft cable.

G. Portable Winch: 120 V, electric type. One required.
   1. Winch Power Connection: Cord and plug.
   2. Winch Raise-Lower Control: Remote-control station with 15 feet of cable.

H. Winch Transformer: Portable, totally enclosed, encapsulated, single-phase, dry type. Primary rated at lighting-circuit voltage; secondary rated at 120 V. Permanent, primary and secondary, twist-locking plug connectors on pigtails shall match pole-base power outlet and winch plug.

PART 2 - EXECUTION

2.01 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.
   1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

2.02 POLE INSTALLATION

A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
   1. Fire Hydrants and Storm Drainage Piping: 60 inches.
   2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
   3. Trees: 15 feet.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03, Section 033000, "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
   1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
   2. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space.
   3. Install base covers, unless otherwise indicated.
   4. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
   1. Dig holes large enough to permit use of tampers in the full depth of hole.
   2. Backfill in 6-inch layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
   1. Make holes 6 inches in diameter larger than pole diameter.
   2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi at 28 days, and finish in a dome above finished grade.
   3. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
   4. Cure concrete a minimum of 72 hours before performing work on pole.

G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable).

2.03 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish

by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03, Section 033000, "Cast-in-Place Concrete".

2.04 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

A. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03, Section 033000, “Cast-in-Place Concrete."

2.05 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533, "Raceway and Boxes for Electrical Systems". In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

2.06 GROUNDING

A. Ground metal poles and support structures according to Section 260526, "Grounding and Bonding for Electrical Systems".
   1. Install grounding electrode for each pole, unless otherwise indicated.
   2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Section 260526, "Grounding and Bonding for Electrical Systems".
   1. Install grounding electrode for each pole.
   2. Install grounding conductor and conductor protector.
   3. Ground metallic components of pole accessories and foundations.

2.07 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
   1. Verify operation of photoelectric controls.

C. Illumination Tests:
   1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
      a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installments."
      b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
      c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
      d. IESNA LM-64, "Photometric Measurements of Parking Areas."

e. IESNA LM-72, "Directional Positioning of Photometric Data."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

E. Furnish original and four copies of the complete report to the Architect in accordance with requirements of Contract Documents.

2.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 01, Section 017900, "Demonstration and Training."

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Contractor shall furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all site clearing work as required and as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

B. Removal of surface debris; removal of paving and curbs; removal of trees, shrubs, and other plant life; topsoil excavation; and repair of damaged vegetation and/or irrigation systems/system components.

C. Removal of concrete and bituminous surfacing.

1.02 RELATED SECTIONS

A. Section 31 20 00: Earthwork.

1.03 REFERENCE STANDARDS

A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("GREENBOOK"), 2021 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".

1.04 REGULATORY REQUIREMENTS

A. The Contractor shall obtain all necessary permits, licenses, or agreements required by any legally constituted agency, pay for all fees and give all necessary notices required for the construction of the work. The School District shall reimburse the contractor for all necessary permits or inspection fees by any legally constituted agency.

B. Perform all work of this Section in strict accordance with applicable Government Codes and Regulations especially meeting all safety standards and requirements of CAL/OSHA, County of Los Angeles and the City of El Monte. Provide additional measures, added materials and devices as may be needed as directed by the District Representative at no added cost to the District.

C. Comply strictly to Rule 1404, South Coast Air Quality Management District.

B. Coordinate clearing Work with utility companies.

PART 2 – PRODUCTS

2.01 Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 31 20 00 – Earthwork.

A. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified.

B. Identify a waste area for placing removed materials.

3.02 PROTECTION

A. Protect existing structures and site improvements indicated to remain, from damage by approved methods and/or as authorized by the District Representative. Removal of all protections shall be when work of this Section is completed or when so authorized by the District Representative.

B. Protect Existing Utilities indicated or made known to remain traversing the job-site and serving existing adjacent facilities.

C. Protect Existing Trees and Shrubs indicated to remain by providing temporary surrounding fencing so located a sufficient distance away so that trees and shrubs will not be damaged by site-clearing operations.

1. Protection Barrier: A protection barrier shall be installed around the shrubs or trees to be preserved. The barrier shall be constructed of a durable fencing material, such as plastic construction fencing, snow fence, or chain link. The barrier shall be placed at or beyond the drip line. "Drip line" as referred to herein means a line which may be drawn on the ground around the tree directly under its outermost branch tips and which identifies that location where rainwater tends to drip from the tree. Placement of barrier to be approved by District Representative (Grounds Supervisor). If barrier is placed inside the drip line, then 3/4 inch plywood must be placed over the root zone up to the drip line. The fencing shall be maintained in good repair throughout the duration of the project, and shall not be removed, relocated, or encroached upon without permission of the District Representative (Grounds Supervisor).

2. Storage of Materials: There shall be NO storage of materials or supplies of any kind within the area of the protection barriers. Concrete, cement, asphalt materials, block, stone, sand and soil shall not be placed within the drip line of the tree(s).

3. Fuel Storage: Fuel storage shall NOT be permitted within 150 feet of any tree to be preserved. Refueling, servicing and maintenance of equipment and machinery shall NOT be permitted within 150 feet of protected trees.

4. Vehicles/equipment: NO parking or driving of vehicles or storage of equipment shall be permitted within the drip line of any tree to be preserved.

5. Debris and Waste Materials: Debris and waste from construction or other activities shall NOT be permitted within protected areas. Wash down of Concrete, cement or asphalt handling equipment, in particular shall NOT be permitted within 150 feet of protected areas.

6. Grade Changes: Grade changes can be particularly damaging to trees. Any grade changes should be approved by the District Representative (Grounds Supervisor) before construction begins and precautions taken to mitigate potential injuries.

7. Damages: Any damages or injuries to the preserved trees (including pruning or cutting of such trees not in conformity with the International Society of Arboricultural Pruning Guidelines and ANSI A300 Pruning Standards) shall be reported immediately to the District Representative (Grounds Supervisor). Severed roots shall be pruned cleanly to healthy tissue, using proper pruning tools. Broken branches/limbs shall be pruned according to International Society of Arboricultural Pruning Guidelines and ANSI A300 Pruning Standards. In the event that any damage, injury, improper pruning or cutting of a protected tree is deemed to be so substantial as to require its replacement (such determination to be made in the sole discretion of the District Representative), Contractor shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.

8. Removal of Existing Tree or Shrub: Prior to removing or cutting any trees designated for removal, the contractor shall coordinate with the District's Ground Supervisor. In the event that Contractor, a Subcontractor, Sub-Subcontractor, material supplier or anyone else performing the Work

of the Contract willfully, negligently or mistakenly removes any tree or shrub not designated for removal, Contractor shall immediately report such removal to the District Representative (Grounds Supervisor). Contractor shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.

9. Unauthorized Tree Removal or Injury: Criminal Penalties: Reference is made to California Penal Code §384a which provides that any person who willfully or negligently cuts, destroys, mutilates or removes any tree or shrub or portion thereof growing on public land without a written permit from the owner of said public land is guilty of a misdemeanor, subject to a fine of up to $1,000, imprisonment in county jail for up to 6 months, or both. Contractor is advised that, in addition to all remedies provided herein and in the Contract Documents, the District shall cooperate with appropriate authorities in prosecuting and enforcing Penal Code §384a and other criminal sanctions as appropriate concerning trees and shrubs located on District property.

10. Preventive Measures: Before construction begins fertilization of the affected areas to be applied at a rate to be determined by the District Representative (Grounds Supervisor).

D. Protect bench marks, survey control points, and existing structures from damage or displacement.

E. Protection of Persons and Property (existing structures and site improvements):

1. Provide barricades, warning signs at open depressions and holes on adjacent property and public accesses.

2. Provide operating warning lights during hours from dusk to dawn each day or as otherwise required.

3. Protect existing remaining structures, utilities, sidewalks, pavements other facilities from damage as caused by settlement, undermining, washout or other hazards created by site-clearing operations of this Section.

F. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors and to others performing work on or near the job-site.

G. Maintain access to the job-site at all times.

3.03 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove all rubbish and debris existing and resulting from work operations of this Section as soon as possible, do not allow to pile up. Do not burn rubbish and debris on the job-site.

C. Where active utility lines need to be capped or plugged, perform such work in accordance with requirements of the Utility Company.

3.04 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Excavate and remove associated plumbing piping.

C. Prior to demolition work, the Contractor shall notify the District Representative to identify the existing items for salvage purposes. The materials identified for salvage shall be returned to the District in a timely manner agreed upon by the District Representative.

3.05 CONCRETE AND BITUMINOUS SURFACE REMOVAL

A. Where noted on the construction drawings, break up and completely remove all existing concrete surfacing, curbs, gutters, walks and bituminous surfacing to limits indicated to be removed. All cutting shall be done to a neat and even line with proper tools or a concrete cutting saw. Minimum depth of cut shall be 1-1/2", unless otherwise specified. Remove any concrete broken beyond the indicated limits to the nearest joint or score line and replace with new concrete to match the existing.

B. Removed concrete and bituminous materials shall be disposed of off-site unless otherwise noted on the construction drawings. All such items to be removed shall be disposed of off the property in a legal manner.

C. Bituminous pavement saw cutting shall conform to the provisions of Section 300-1.3.2 (a) of the Standard Specifications. The residue resulting from the saw cutting operations shall not be permitted to flow beyond the specific work location and shall be removed the same day.

D. Removal of concrete curb / curb & gutter covered by this section shall include saw-cutting and removal of a twelve (12") inch wide section of the adjacent bituminous pavement.

E. When saw cutting concrete curb / curb & gutter, the cuttings shall be continuously wet vacuumed to prevent the materials from entering catch basins, storm water conveyances, or waters of the State. Vacuumed cuttings shall be disposed of according to applicable regulations.

F. Concrete curb and concrete curb and gutter shall be removed to the lines, grades and locations shown on the plans in accordance with Section 300-1.3.2 of the Standard Specifications.

G. Concrete removal in sidewalk and driveway areas shall extend to existing score lines unless specifically indicated otherwise on the Plans or in the Project Special Provisions, or unless otherwise approved by the Engineer.

H. Reinforcing or other steel may be encountered in portions of concrete to be removed. No additional compensation will be allowed for the removal of concrete containing reinforcing or other steel.

I. In those areas where existing bituminous surfacing is removed to make way for new planting or lawn areas, remove soil 6” below existing exposed soil surface. Removed soil may be used only as fill under buildings or other areas to be paved, only if approved by the District Inspector. Legally dispose of off site, if material is not approved as fill material.

3.06 REPAIRS

A. During demolition and construction, ensure that trees, shrubs and other plant material and vegetation are protected inside and outside of the work zone and that the vegetation is being watered, maintaining the proper moisture content according to the season. Failed vegetation, including sod, due to lack of water, and/or plant material destroyed during construction period are to be replaced to equal or better size and condition at no additional cost to the District.

B. If the irrigation system is damaged or modified during construction, it shall be repaired to the Districts standards, and shall be in equal or better condition than prior to damage or modification. All repairs shall be, inspected and approved by the District Representative (Grounds Supervisor) prior to backfilling or covering of said repairs. The District representative requires forty-eight hours prior notice, when contractor requests inspection of completed repairs. All repairs shall be made so as to ensure proper operation prior to the close of the contract at no additional cost to the District.

C. Controller Wires: If damaged, cut or removed, repair by splicing, soldering and silicone sealing. To ensure proper operation, reconnect the wires to the valve to correspond with the map on the controller to the correct station.

D. Hydraulic Tubes: If damaged/cut or removed, repair by replacing the tubing using equal or better material.

E. Valves: If damaged, repair/replace with equal or better material. All valves are to be flushed/cleaned thoroughly.

F. Mainlines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.

G. Lateral Lines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.

H. Irrigation Heads: If damaged, repair/replace with equal or better material. All heads are to be flushed and filters cleaned thoroughly.

I. Controllers: If damaged repair/replace with equal or better material.

J. Backflow Prevention Devices: If damaged, repair/replace with equal or better material.

K. Gate/Ball/Quick Coupler Valves: If damaged repair/replace with equal or better material.

L. Valve Boxes: If damaged, repair/replace with equal or better material. Concrete boxes and concrete lids with the appropriate markings for identification shall be used. The top of the box shall be buried below finish grade, equal to existing depth or deeper. The top of the valve stems shall be 6" below the underside of the top of the box.

M. Construction in grass areas: Sod shall be removed by sod cutting at a soil depth of 2", stored on site, and watered on a daily basis. Upon completion of work, stored sod shall be reinstalled over the areas disrupted due to construction. An option may be to bypass cutting the sod, however at the completion of the project, finish grading and installation of new Hybrid Bermuda GN -1 sod over the areas disrupted by construction shall be required.

3.07 EXCESS MATERIALS DISPOSAL

A. 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.

3.08 SITE CLEANUP

A. Cleanup of branches, limbs, logs, or any other debris resulting from any operations shall be promptly and properly accomplished. The work area shall be kept safe at all times until all operations are completed. Under no circumstances shall the accumulation of brush, limbs, logs, or other debris be allowed in such a manner as to result in a hazard to the public. All debris shall be cleaned up each day before the work clew leaves the site, unless permission is given by the Owner to do otherwise. All lawn areas shall be raked, all streets and sidewalks shall be swept, and all brush, branches, rocks or other debris shall be removed from the site. Areas are to be left in a condition equal to or better than that which existed prior to the commencement of operations.

END OF SECTION

SECTION 31 20 00

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. The work of this section shall include excavation, unclassified cut, unclassified fill, removing existing unsatisfactory material, preparing areas to be filled, spreading and compacting of fill in the areas to be filled, and all other work necessary to complete the grading of the site. It shall be the Contractor's responsibility to place, spread, moisten or dry, and compact the fill in strict accordance with these specifications to the lines and grades indicated on project plans Included with this Work are the following:

1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.
2. Excavating, filling, backfilling, and compacting for Project site pavement, planting areas, buildings, and other structures.
3. Base course for walks and pavements.
4. Excavating and backfilling trenches within buildings lines.
5. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.
6. Not applicable.

B. Related Sections: The following Sections contain requirements that relate to this Section.

1. Not applicable.

1.02 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off site when sufficient approved soil material is not available from excavations.

D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.

E. Permeable Backfill: Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations.

F. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below ground surface.

H. Utilities include underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.03 QUALITY ASSURANCE

A. Codes and Standards:

1. 2019 California Building Code, Title 24, Part 2, Volume 2 of 2, Appendix J, Grading.
2. ASTM D422 - Method for Particle Size Analysis of Soils
3. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 kg) and 18-inch (457-mm) Drop.
5. ASTM D2216 - Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.
6. ASTM D2922 - Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).
7. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).
8. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
9. ASTM D4829 - Expansion Index Test.

B. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("GREENBOOK"), 2021 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".

C. Professional Observation: A soils engineer will be retained by the Owner for purposes of inspection, testing and approval of all work under this section.

Perform work of this Section under inspection and approval of the soils engineer. Give soils engineer not less than 48 hours advance notice of readiness for inspection.

D. The soils engineer will have the authority over all filling, grading, and compaction operations, including interruption of work if deemed necessary due to improper work

1.04 CONSTRUCTION MONITORING

A. All earthwork and foundation construction should be monitored by a qualified engineer/technician under the supervision of a testing lab , including;

1. Observation of all site preparations;
2. Observation of shoring installation, if needed:
3. Observation of all site excavations;
4. Test and approval of all import soil;
5. Observation of placement of all compacted fills and backfills;
6. Observation of all surface and subsurface drainage systems;
7. Observation of all foundation and pile excavations;
8. Observation of subgrade preparation for paved and building areas.

B. The testing lab of Record should be notified at least three (3) days in advance of the start of construction. A joint meeting between the Contractor and testing lab is recommended prior to the start of construction to discuss specific procedures and scheduling. The testing lab should be present to observe the soil conditions encountered during construction, to evaluate the applicability of the recommendations presented in the Soils Report to the soil conditions encountered, and to recommend appropriate changes in design or construction if conditions differ from those described herein. The testing lab of Record should inspect and approval all imported backfill material prior to its placement as backfill, approve the subgrade beneath all fills, fill placement and bottom of all foundation excavations before concrete or steel is placed.

C. The testing lab shall submit compaction reports to the Construction Manager and the Civil Engineer at the completion of the work, including test results and plot plans indicating the locations from which the tested samples of fill were taken. The testing lab shall keep the Construction Manager informed on the progress of the grading work.

1.05 IMPORT AND EXPORT OF EARTH MATERIALS

A. Fees: Pay as required by government authority having jurisdiction over the area.

B. Bonds: Post as required by government authority having jurisdiction over the area.

C. Hauling Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.06 DIG ALERT NOTIFICATION

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

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

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

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

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

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

1.07 PROJECT CONDITIONS

A. Data: Maps, boring logs, geotechnical and foundation investigation reports, and like reference data, not included in Contract Documents but made available to Contractor by Owner are for information only, and the Owner assumes no responsibility for any conclusions Contractor may draw from such information. Should questions or issues arise, contact Owner for clarification.

B. Contractor shall determine existing conditions under which the Contractor will operate in performing the Work

C. Information on Drawings does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

D. Existing utilities: Locate existing underground utilities in all areas of work prior to excavation or commencement of work. If utilities are to remain in place provide adequate means of protection during earthwork operations.

1. Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult Utility Owner immediately for direction. Cooperate with

Owner and Utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of Utility Company.

2. Do not interrupt existing utilities serving facilities occupied or used by Owner, or others, except when permitted in writing by Owner's Representative, and then only after acceptable temporary services have been provided.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut off of services if lines are active.

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

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

G. Existing Conditions: Prior to commencing work at site, verify agreement of existing conditions with indicated conditions. Notify Owner's Representative in writing of discrepancies found. Start of work without notification constitutes acceptance of conditions, without cause for extra compensation.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: All soils materials to be used throughout the site shall be approved for use by the testing lab . Provide approved borrow soil materials from off site when sufficient approved soil materials are not available from excavations.

B. The Contractor is solely responsible for verifying the earthwork quantities necessary to complete the project.

C. For earthwork volume estimating purposes, an average shrinkage volume of 10 percent and subsidence of a 1/2-inch may be assumed for the surficial soils. These values are estimates only and exclude losses due to removal of vegetation and debris. Actual shrinkage and subsidence will depend on the types of earthmoving equipment used and should be determined during grading.

D. Satisfactory Soil Materials: In general, the on-site earth materials should be suitable for reuse as fill, provided that environmentally impacted soils found

during preliminary endangered assessment, if any, are first excavated and removed from the site. Fill material should also be free of trash, debris, roots, vegetation, or other deleterious materials. Fill should generally be free of rocks or lumps of material in excess of 4 inches in diameter. Rocks or hard lumps larger than approximately 4 inches in diameter should be broken into smaller pieces or should be removed from the site. Fill used as structural backfill, should be comprised of granular, non-expansive soil that conforms to the latest edition of "Greenbook" Standard Specifications for Public Works Construction (Greenbook) for structural backfill. "Non- expansive" is defined as soil having an EI of 20 or less in accordance with ASTM International (ASTM) D 4829 (CBC, 2019).

E. Import Fill Material: Imported materials should consist of clean, non-expansive granular material which conforms to the 2018 edition of Greenbook. The imported materials should meet the Caltrans (2012) criteria for non-corrosive soils (i.e., soils having a chloride concentration of 500 parts per million [ppm] or less, a soluble sulfate content of approximately 0.20 percent [2,000 ppm] or less, a pH value of 5.5 or higher and a minimum resistivity of 1,000 ohm-centimeters [ohm-cm] or higher). Materials for use as fill should be evaluated by the testing lab prior to importing. The contractor should be responsible for the uniformity of import material brought to the site.

F. Base Course Material For Use Under Hardscape: Crushed Aggregate Base (CAB) per Section 200-2.2, 3/4" maximum of the Standard Specifications for Public Works Construction (Green Book).

G. Engineered Fill: Satisfactory Soil Materials / Borrow Fill Material, as described above, placed in lifts no greater than 8 inches thick (loose measurements) and each lift moisture conditioned per the soils report. All engineered fill should be densified to a minimum relative compaction of 90 percent per ASTM D 1557.

H. Bedding Material for Trenches:

1. Bedding sand shall be as defined by Standard Specifications, Section 200-1.5, and shall be free of expansive material and organic matter. Bedding material for utility lines outside the property lines shall be as required by the agency having jurisdiction. On-site soils are not considered suitable for bedding of utilities.

2. Sand providing a sand equivalent of at least 35. All of the sand bedding shall be compacted to a minimum 90 percent of maximum density by mechanical means. Flooding and jetting shall not be permitted without prior written approval from the testing lab . Where sheeting or shoring is used densification of the bedding shall be accomplished after the sheeting or shoring has been removed from the bedding zone, unless the sheeting or shoring is to be cut off or left in place. Pipe bedding material shall be placed in horizontal layers not exceeding (8) eight inches.

I. Backfill Material for Trenches:

1. The on-site soils have been determined to be suitable for being used for backfilling purposes in trenches. Utility trenches should be backfilled with granular materials and mechanically compacted to at least 90% of the maximum dry density of the soils.

J. Permeable Base Course Material Under Synthetic Turf: Permeable base material meeting Caltrans 2015 Specification section 68-2.02F(3).

K. Base Material Around Perimeter Subdrains: 3/4-inch washed crushed rock per ASTM #67.

2.02 ACCESSORIES

A. The soil isolation fabric is a standard nonwoven geotextile fabric of polypropylene geotextile, “Mirafi 140N” or approved equal.

B. Detectable Warning Tape: Acid and alkali-resistant polyethylene film metallic warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.

1. Tape Colors: Provide tape colors to utilities as follows:

a. Red: Electric.

b. Yellow: Gas, oil, steam, and dangerous materials.

c. Orange: Telephone and other communications.

d. Blue: Water systems, with “Caution: Water Line Below.”

e. Red Water systems, with “Caution: Fire Water Line Below.”

f. Green: Sewer systems, with “Caution: Sewer Line Below.”

2.03 EXCAVATION SUPPORT & PROTECTION – SHORING PLAN

A. The CONTRACTOR shall have at the Worksite, copies or suitable extracts of: Construction Safety Orders, Tunnel Safety Orders and General Industry Safety Orders issued by the State Division of Industrial Safety. The CONTRACTOR shall comply with provisions of these and all other applicable laws, ordinances, and regulations.

B. Before excavating any trench 5 feet or more in depth, the CONTRACTOR shall submit a detailed plan to the Owner showing the design of shoring, bracing, sloping, or other revisions to be made for the Workers’ protection from the hazard of caving ground during the excavation of such trench. If the plan varies from the shoring system standards, the plan shall be prepared by a registered Civil Engineer. No excavation shall start until the OWNER has accepted the plan and

the CONTRACTOR has obtained a permit from the State Division of Industrial Safety. A copy of the permit shall be submitted to the OWNER.

C. The INSPECTOR will provide a competent person trench/excavation certification form to the CONTRACTOR. It shall be completely filled out before any worker has access to trench or excavation and returned to the INSPECTOR before the end of the first working day. The CONTRACTOR shall certify by this form the name of the competent person administering the Work, the soil classification, and the type of excavation protective system provided and/or installed.

D. The CONTRACTOR shall completely fence all excavations to provided protection against anyone falling into the excavation and to the satisfaction of the INSPECTOR. The fencing shall be in place at all times except when workers are present and actual construction operations are in progress.

E. The fencing material shall be chain link fabric or welded wire fabric (6x6-W9xW9 minimum) and 6 feet high, constructed according to one of the following:

1. Tensioned fencing material and have top and bottom tension wires securely fastened to driven steel posts or other equally rigid elements at a maximum spacing of 12 feet; or

2. Untensioned fencing materials securely fastened to extended trench shoring elements at a maximum spacing of 8 feet and fastened to continuous top and bottom rails constructed of nominal 2 in x 4 in lumber or equally rigid material. Framed panels with suitable supporting elements fastened together to form a continuous fence may also be used.

PART 3 - EXECUTION

3.01 PREPARATION

A. Use Laser technology to verify construction and accurate elevations and slopes required.

B. Protect adjacent property and existing improvements and structures as necessary to prevent undermining, caving of cuts, and miscellaneous damage.

C. Provide cribbing, sheeting, and shoring necessary to safely retain the earth banks and protect excavations and adjoining grades from caving and other damage resulting from excavating together with suitable forms of protection against bodily injury to personnel employed on the work and the general public. Be responsible for the design, installation, and maintenance of required cribbing and shoring and shall meet the approval of the State Division of Industrial Safety and local governing agencies requirements.

D. Utility lines and structures shown shall be protected and treated as indicated. Where work not shown is encountered, report it to the Architect before proceeding with excavation. Encase active lines in sleeves where they pass through concrete; remove inactive lines as directed, and plug the remaining

ends. Bear the costs for repairs to damaged or broken utilities and any damages related thereto.

E. Protect existing improvements and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. Prevent silt run-off from the limits of work in accordance with governmental requirements.

3.02 DEWATERING

A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Any water entering an excavation shall be immediately pumped out and the exposed excavation allowed to ry.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.03 GRADE STAKES

A. The Contractor's Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor, and shall be subject to the approval of the OWNER. Contractor shall notify the OWNER at least 48 hours before staking is to be started. The OWNER will determine if work is ready for staking.

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

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

D. Grades for underground conduits will be set at the surface of the ground. The Contractor shall transfer them to the bottom of the trench.

3.04 FIELD FINISHED PERMEABLE BASE CONTOUR AND FLATNESS

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

B. It is recommended that the native soil below proposed crushed base material under hardscape areas, be over excavated to the recommended minimum depth

3.05 EXCAVATION, BACKFILL & COMPACTION FOR UTILITIES

A. Field conditions may require deviations from information indicated on Drawings. Such changes in work shall be covered by a Change Order, indicating an increase or decrease in the Contract sum.

B. Before excavation, Contractor shall contact the "Underground Service Alert of Southern California" (USASC) for information on buried utilities and pipelines.

C. When connections are to be made to any existing pipe, conduit, or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate for, and expose, the existing improvement before laying any pipe or conduit. The Engineer shall be given the opportunity to inspect the existing pipe or conduit before connection is made. Any adjustments in line or grade which may be necessary to accomplish the intent of the plans will be made, and the Contractor will be paid for any additional work resulting from such change in line or grade.

D. Trenches, ditches, pits, sumps, and similar items which are outside the barricaded working area shall be barricaded to conform to Cal OSHA standards.

E. Trenches over 5'-0" in depth shall conform to the Construction Safety Orders of the California Division of Industrial Safety, see Section 2.3 EXCAVATION SUPPORT & PROTECTION – SHORING PLAN.

F. Safe and suitable ladders which project 2 feet above the top of the trench shall be provided for all trenches over 4 feet in depth. One ladder shall be provided for each 50 feet of open trench, or fraction thereof, and be so located that workers in the trench need not move more than 25 feet to a ladder.

G. Where indicated and/or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

H. All trenches should be backfilled with approved fill material compacted to relative compaction of not less than 90 percent of maximum density determined in accordance with ASTM D 1557. Backfill shall be placed in layers not exceeding 8” (inches) in thickness.

I. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.

J. Do not excavate trenches parallel to footings closer than 18" from the face of the footing or below a plane having a downward slope of 2 horizontal to one vertical, from a line 9" above bottom of footings.

K. Unless indicated otherwise on the plans are within this specification, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks,

with minimum allowances of 6 inches at the bottom for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Maximum allowances at the sides for trenching shall be 12 inches. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.

L. Where portions of existing structures, walks, paving, etc. must be removed or cut for pipe or conduit installation, replace the material with equal quality, finished to match adjacent work.

M. Provide a minimum clear dimension of 6 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and/or tanks.

N. DO NOT place backfill until the bedding and pipe work installed has been inspected, tested and approved by the County Inspector. Remove excavated rocky material unsuitable for backfill from the site prior to final backfilling.

O. Bedding material immediately around a utility line and to a point 6 inches above the line should consist of sand to support the line and protect it.

P. Bedding zone shall be defined as the area containing the material specified that is supporting, surrounding, and extending to 6” (inches) above the top of pipe for storm drains. Compaction requirements in this area must meet 90% minimum.

Q. Bedding material shall first be placed on a firm and unyielding subgrade so that the pipe is supported for the full length of the barrel. There shall be 6” (inch) minimum of bedding below the pipe barrel and 1” (inch) clearance below a projecting bell for storm drain pipe. The material in the bedding zone shall be placed and densified by mechanical compaction only.

R. Mechanically compacted backfill shall comply with section 306-1.3.2 of the Standard Specifications for Public Works Construction.

S. Above the bedding, up to finished subgrade at areas other then landscape areas and up to one foot below flatwork and pavements, utility trenches should be backfilled with granular materials and mechanically compacted to at least 90%.

T. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of bottom of footings.

U. Fill voids with approved backfill materials as shoring bracing and sheeting is removed.

3.06 INSPECTION & TESTING AT TRENCHES

A. Pipe will be inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be subject to rejection. Any corrective work shall be approved by the civil engineer of record and shall be at NO cost to the Owner.

B. The Inspector and/or testing lab will inspect all subgrades and excavations prior to placing bedding & backfill materials.

C. DO NOT place backfill until the bedding and pipe work installed has been inspected, tested and approved by the Inspector. Remove excavated rocky material unsuitable for backfill from the site prior to final backfilling.

D. Utility backfill compaction test shall be performed in accordance with ASTM D1557, method "C".

E. Utility backfill in place density test per ASTM D 1556 (sand cone) or other test method as considered appropriate by the testing lab .

F. Hydrostatic pressure tests shall be done only after backfill has been placed and final compaction has been achieved.

3.07 APPROVAL OF SUBGRADE

A. Notify testing lab when excavations have reached required over-excavation subgrade.

B. When testing lab determines that unforeseen unsatisfactory soil is present, continue work only after receiving direction from the Owner.

C. Reconstruct subgrades damaged by rain, accumulated water or construction activities as directed by the Soils Engineer.

3.08 UNAUTHORIZED EXCAVATION

A. Fill of unauthorized excavation below bottoms of foundations or wall footings will be engineered fill.

B. Fill unauthorized excavations under other construction as directed by the Soils Engineer.

C. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the testing lab .

3.09 PLACEMENT OF ENGINEERED FILL

A. Spreading and Compacting Fill Material:

1. Fill and trench backfill should be compacted in uniform horizontal lifts to a relative compaction of 90 percent or more as evaluated by the latest edition of ASTM D 1557. Fill soils should be moisture-conditioned to above the optimum moisture content as evaluated by the latest edition of ASTM D 1557. The optimum lift thickness of fill will depend on the type of compaction equipment used but generally should not exceed 8 inches in loose thickness. Special care should be taken to avoid pipe damage when compacting trench backfill above pipes. Placement and compaction of the fill soils should be in general accordance with the appropriate governing agencies and good construction practices.

B. Compaction Testing:

1. The testing lab 's representative shall observe the excavation, filling, and compacting operations and shall make density tests in the fill material so that he can state his opinion as to whether or not the fill was constructed in accordance with the specifications. If the surface is disturbed, the density tests shall be made in the compacted materials below the disturbed zone. When these tests indicate that the density or moisture content of any layer of fill or portion thereof does not meet the specified density or moisture content, the particular layer or portions shall be reworked until the specified density and moisture content have been obtained.

2. Sampling and testing of materials for determination of compliance with the specified compaction requirements will be conducted by the testing lab's representative at any location and time as the Owner may determine.

3. The Contractor shall be responsible for excavation of the test pits and for providing and installing any shoring, ladders, or other equipment necessary to protect the testing personnel. The Contractor shall also suspend operations as necessary and at no cost to the owner for the purpose of conducting such testing.

4. Test pits shall be excavated in the backfill by the Contractor as directed by the Engineer for the purpose of testing the backfill compaction. At the option of Engineer, density tests may be taken on a lift of compacted backfill immediately before placing the next lift.

5. Any settlement noted in backfill, fill, or in structures built over the backfill or fill within the one-year warranty period will be considered to be caused by improper compaction methods and shall be corrected at the Contractor’s expense. Structures damaged by settlement shall be restored to their original condition by the Contractor at the Contractor’s expense.

6. When initial compaction testing performed by the Engineer indicates the required density has not been obtained, the Contractor shall re-compact or replace the backfill as necessary to meet the specified minimum density.

7. The Contractor shall be responsible for rescheduling compaction testing with the Engineer and shall bear all costs for subsequent retesting in the areas of noncompliance. Costs associated with retesting and scheduling delays shall be the sole responsibility of the Contractor. The Engineer will deduct the costs for testing of materials and work found to be unacceptable, as determined by the tests performed by the Owner and the costs for testing of material sources identified by the Contractor which are not used for the work, from moneys due or to become due to the Contractor. The amount deducted will be determined by the Engineer.

3.10 BACKFILL - GENERAL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

2. Provide red line mark ups for locations of installed underground utilities that vary from the County approved version for as-built plan purposes.

3. Testing, inspecting, and approval of underground utilities.

4. Concrete formwork removal.

5. Removal of trash and debris from excavation.

6. Removal of temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.11 FIELD QUALITY CONTROL

A. A testing lab , designated by the Owner, will be engaged to perform continuous inspection of the placing and compacting of all fills and backfills within the limits of grading of this project. All work shall be done in accordance with the approved plans and these specifications and as recommended and approved by the testing lab . Revised recommendations relating to conditions differing from the approved soils engineering and engineering geology reports shall be submitted to the owner, inspector, architect and the civil engineer. Costs for all such inspections and tests shall be paid by the Owner. The Contractor shall be responsible for notifying the testing lab in advance so that he may be present to perform his services as needed.

B. The testing lab shall submit compaction reports to the Construction Manager and the Architect at the completion of the work, including test results and plot plans indicating the locations from which the tested samples of fill were taken. The testing lab shall keep the Construction Manager informed on the progress of the grading work.

C. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field in-place density tests according to ASTM D 1556 (sand cone method) or other test method as considered appropriate by testing lab .

    a. Field in place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.

    b. When field in place density tests are performed using nuclear methods, make calibration checks of both density and moisture

gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.

2. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.

3. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in place density test for each 150 feet or less of trench, but no fewer than two tests.

D. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

E. Owner's inspector will inspect foundation excavations when completed and ready for forms, after forms are in place, and before first placement of concrete.

3.12 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Architect; reshape and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.13 MAINTENANCE

A. Install and maintain all temporary erosion control devices, including gravel bags, de-silting basins, inlet barricades, vehicle wash traps, and other features called for on the Erosion Control Plans and as required per Storm Water Pollution Prevention Plan.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape to required tolerances, and compact to required density prior to further construction.

3.14 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 the Owner's property.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 REQUIREMENT

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated in the Contract Documents and specified herein.

B. The following types of pavement shall be covered in this Section:
   1. Paving for utility trenching, parking lots, playgrounds, areas between buildings, adjacent to planting and turf areas, and as indicated on Construction Documents.

C. Related Sections:
   1. Section 31 20 00: Earthwork.
   2. Section 32 12 36: Seal Coat.
   3. Section 32 17 13: Pavement Markings.

1.2 QUALITY ASSURANCE

A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction (“GREENBOOK”), 2021 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the “Standard Specifications”.

B. The Owner's inspector shall test the temperature of each batch of asphaltic concrete prior to placement. At the time of delivery to the work site, the temperature of mixture shall not be lower than 260 degrees F or higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather. If asphaltic concrete temperature is not within these tolerances the affected batch shall be rejected. Any and all costs due to the rejected asphaltic concrete shall be the responsibility of the paving contractor.

1.3 ESTABLISHMENT OF GRADES

A. The Contractor’s Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor, and shall be subject to the approval of the Owner. Contractor shall notify the Owner at least 48 hours before staking is to be started. The Owner will determine if work is ready for staking.

B. All work shall conform to the lines, elevations, and grades shown on the Construction Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be

reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

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

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

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

1.4 SUBMITTALS

A. Mix Designs: The CONTRACTOR shall formulate a job-mix formula using the Hveem method in accordance with Standard Specifications Section 203-6.2 and submit it to the ENGINEER for approval. The resultant mixture shall have Hveem properties conforming to Standard Specifications Section 203-6.4.3.

B. Samples:

1. Prior to the delivery of specified aggregate to the site, the CONTRACTOR shall submit samples of the material for the INSPECTOR’s acceptance in accordance with Standard Specifications Section 4-1.4. Samples shall be typical of materials to be furnished from the proposed source and in conformance with the specified requirements.

2. Aggregate base gradation and quality certifications shall be dated within 30 days of the submittal.

C. Certificates

1. Twenty days prior to the delivery of aggregates, asphalt materials, and paving mixes to the project site, the Contractor shall submit to the Engineer certificates and test results of compliance of such materials with these specifications.
2. Submit certificates of compliance from the supplier for bituminous materials for paint binder, asphaltic concrete, and seal coat.
3. Submit weigh master's certificates or certified delivery tickets for each truck load of asphaltic material delivered to the project site.
4. Upon completion of the weed control treatment, and as a condition for final acceptance, furnish a written certificate stating the brand name of the sterilant and the manufacturer, and that the sterilant used had at least the minimum required concentration, and that the rate and method of application complied in every respect with the conditions and standards contained herein.

1.5 QUALITY CONTROL

A. Asphaltic Concrete Producers Qualifications: Use only materials furnished by a bulk asphaltic concrete producer regularly engaged in production of hot mix, hot laid bituminous concrete.

B. Applicator Qualifications: Paving machine and roller operators shall be fully trained and experienced in the installation of asphaltic concrete paving on projects of similar size and complexity.

C. Regulatory Requirements: The quantity of volatile organic compounds (V.O.C.) used in weed killer, seal coat, primer and other materials shall not exceed the limits permitted under the current regulations of the local authorities having jurisdiction.

1.6 ENVIRONMENTAL LIMITATIONS

A. Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Tack Coats: Minimum surface temperature of 60 deg F.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

1.7 PAVEMENT-MARKING PAINT

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Base Course Material: Crushed aggregate base material shall consist of materials that meet the provisions of Specifications Section 31 20 00 Earthwork, Part 2.01F.

B. Asphalt Surfacing Materials: Furnish asphalt surfacing meeting the following requirement, furnished from a commercial asphalt central mixing plant.

1. Paint Binder/Tack Coat: Asphalt emulsion shall be CSS-1 or CSS-1h and shall conform to the requirements of Standard Specifications Section 203-3 Emulsified Asphalt.
2. Asphalt Concrete Composition & Grading:
   a. Synthetic track surface course asphalt concrete shall conform to Standard Specification Section 203-6.4.3, Type D2, with asphalt content of 4.8% to 6.5%

b. Asphalt concrete in all areas except synthetic track shall conform to Standard Specification Section 203-6.5.4, Type III-C3-PG-64-10.
c. Asphalt performance grade shall be PG-64-10.
d. Rubberized asphalt paving is not allowed.

C. Weed Control:

1. The soils sterilant shall be in accordance with current EPA acceptable standard and the California Department of Pesticide Regulations for soils sterilant. Sterilant shall be selected as appropriate for the environment in which is it to be placed. Contractor shall be licensed with the State of California to apply sterilant. Sterilant shall be commercial grade for commercial application. Payment for soil sterilization will include full compensation for application and all materials and incidental work required.
2. Apply Dow Elanco Spike 80DF, or approved equal, to the subgrade soil under all new asphalt, prior to asphalt paving. Spike 80DF weed control should be applied at the rate of seven pounds per acre. If another manufacturer is used follow their recommendations.

D. Headers and Stakes:

1. Headers: Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated on construction drawings
2. Stakes: 2 x 4 redwood or 2 x 3 Douglas fir, Construction Grade.
3. Nails: Common, galvanized, 12d minimum.

PART 3 - EXECUTION

3.1 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to fasten headers in place

3.2 SUBGRADE PREPARATION

A. Subgrade Preparation:
   1. Refer to Detail 2 on sheet C003 for requirements.

B. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual subgrade preparation will have to be determined on the basis of in-grading observations and testing performed by representatives of the project testing lab .

C. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the testing lab to verify that the over-excavation depths, shown on the construction drawings for asphalt concrete pavement structural sections, have been achieved prior to re-compaction.

D. Subgrade tolerances: Subgrade for pavement shall not vary more than 0.02' from the specified grade and cross section established by the Engineer. Subgrade for subbase or base material shall not vary more than 0.04' from the specified grade and cross section. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

E. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.

F. Where filling is required, scarify the subgrade to bond the new material to the in place material; use additional material as required, subject to the approval of the Architect, and provided by the Contractor.

G. Remove excess material from the site to a legal disposal area.

3.3 APPLICATION GENERAL

A. Finish elevations, extent of asphalt paving and locations of type of asphalt and class of base shall be as indicated and specified herein and on the Construction Documents. Bring subgrade elevations sufficiently below the finish elevations of the paving so as to accommodate the thickness of paving and base.

3.4 STERILANT APPLICATION

A. Place herbicide below all aggregate base course under new asphalt pavement. Meet the applicable environmental control requirements. Apply as directed by the manufacturer's printed instructions just before application of the base course. Sterilant shall not be applied within two feet of planting areas.

3.5 APPLICATION OF BASE COURSE

A. Install base course material, encompassing spreading and compacting, in accordance with the S.S.P.W.C. Section 301-2, Untreated Base.

B. After preparing the subgrade all traffic on the subgrade shall be avoided. Should it be necessary to haul over the prepared subgrade, the CONTRACTOR shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

C. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross-section, will not be permitted. The CONTRACTOR shall protect the prepared subgrade from all traffic.

D. Maintain the surface in its finished condition until the succeeding layer is placed.

3.6 PLACING ASPHALT CONCRETE SURFACING:

A. Asphalt binder (tack coat) shall be applied to all existing pavement surfaces to be overlaid and/or joined per section 302-5.4 of the Standard Specifications. Asphalt binder (tack coat) shall be applied to existing surfaces to be surfaced and between layers of asphalt concrete, except when eliminated by the Engineer. A layer of asphalt binder (tack coat) shall be applied to all vertical-cut faces and between subsequent AC lifts.

B. Asphalt Concrete Pavement:

1. All work shall be in accordance with Section 302-5 of the Standard Specifications, except as noted herein. Asphalt concrete work shall include full-depth patching and variable thick asphalt concrete transition areas. The Contractor shall, on a daily basis, provide the Inspector with copies of certificates of weight for all materials delivered to the job site and/or incorporated in the work. At no time shall the coarse aggregate that has segregated from the mix be scattered across the paved mat.
2. Asphalt concrete shall not be placed on any surface, which contains ponded water or excessive moisture in the opinion of the Engineer. If paving operations are in progress and rain or fog forces a shut down, loaded trucks in transit shall return to the plant, and no compensation will be allowed therefore. The Contractor shall furnish and use canvas tarpaulins to cover all loads of asphalt from the time that the mixture is loaded until it is discharged from the delivery vehicle, unless otherwise directed in writing by the Engineer
3. The Inspector will examine the base before the paving has begun. The Contractor will correct any deficiencies before the paving is started.
4. Successive courses may be laid upon previously laid courses as soon as the previous course has cooled sufficiently to show no perceivable displacement under equipment or loaded material delivery trucks and a tack coat has been applied.

5. Wherever AC pavement does not terminate against a curb, gutter, or another pavement, the Contractor shall provide and install a redwood or pressure treated Douglas fir header at the line of termination.
6. Smoothness of asphalt shall conform to section 302-5.6.2 of the Standard Specifications
7. Density shall conform to the below requirements:
    a. In-place density of the Asphalt Concrete will be based on test results from a nuclear gauge and core samples taken in accordance with CTM 375, “Determining the in Place Density and Relative Compaction of Asphalt Concrete Pavement” except as modified below. The Inspector will determine when core sample testing shall be completed.
    b. Asphalt Concrete shall be compacted to not less than 95.0 percent for a single test and not less than an average in place density of 96.0 percent relative compaction of the Laboratory Test Maximum Density as determined by, Caltrans Testing Method (CTM) 375 except as modified by these specifications.
    c. The materials testing laboratory, paid for by the contractor, will obtain random samples of the hot mix asphalt material from behind the paving machine in accordance with Caltrans Testing Method (CTM) 125, “Methods for Sampling Highway Materials and Products in Roadway Structural Sections”, to determine the Laboratory Test Maximum Density of the asphalt mixture in accordance with CTM 308.
    d. Asphalt Concrete compaction shall be accepted based upon passing tests taken from the nuclear gauge. In the event that the nuclear gauge testing presents failing results, then core samples will be the determination for the in place density and acceptance or rejection of the compaction.
    e. When core testing is to be performed to determine the relative compaction after nuclear gauge testing has not produced passing tests, the materials testing laboratory will obtain four 4” diameter core specimens (or four 6” diameter core specimens) for determination of relative density of the completed pavement. The four cores shall represent the sample frequency requirements specified in CTM 375.
8. Pavement at all longitudinal joints shall have a Field Density of 95%, as described in 302-5.6.2 of the Standard Specifications. When the test results of the field cores are less than 95% Relative Compaction, the Contractor shall remove a 1 foot wide section on each side of the longitudinal joint. The Contractor shall replace the removed pavement with an asphalt mix that meets the job specification at no additional cost to the Owner.

3.7 FLOOD TESTING

A. Flood Test: Before acceptance, all pavements shall be water tested to ensure proper drainage as directed by the Inspector. The Contractor shall provide water for this purpose. The flooding shall be done by water tank truck. Depressions where the water ponds to a depth of more than 1/8-inch shall be filled or the slope corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. No standing water shall remain after 60 minutes on a 70 degree F (or warmer) day.

3.8 SEAL COAT

A. Allow new asphalt pavement to cure 30 days before application of seal coat. See Project Specification Section 32 12 36: Seal Coat.

3.9 FIELD QUALITY CONTROL

A. Thickness: Tolerances for asphalt pavement thickness shall be ¼ inch, plus or minus.

B. All paving shall drain properly before being accepted. Upon completion, the pavement shall be true to grade and cross section. The asphalt substrate, shall not vary from the planned cross slope by more than +- 0.1. When a 10 foot straightedge is laid on the finished surface of the asphalt, the surface shall not vary from the edge of the straightedge more than 1/4 inch, except at grade breaks. Where paving does not meet these tolerances, the paving material shall be repaired by a method determined by the Owner. Repairs shall not be made to pavement surface by feather-edging at the join lines. All expenses for pavement repair up shall be borne by the Contractor at NO cost to the Owner.

C. Corrective Measures: It is the Contractor's responsibility to determine if the planarity, cross slopes, and general specifications have been met. If all of the conditions have been met the Contractor must notify the Owner in writing of the acceptance of the asphalt paving.

D. Asphalt Paving and other Concrete Paving finishes along the Accessible Route of Travel shall be Slip Resistant.

3.10 PROTECTION

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

3.11 CLEAN UP

A. Clean all debris and unused materials from the paving operation. Clean all surfaces that have been spattered or defaced as a result of the paving operation. Asphalt or asphalt stains which are noticeable upon surfaces of concrete, or materials which will be exposed to view, shall be promptly and completely removed. Cleaning shall be done in a manner that will not result in any discharge of contaminated materials into any catch basin. All expenses for clean up shall be borne by the Contractor at NO cost to the Owner.

END OF SECTION

SECTION 32 12 36
SEAL COATS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface sealer over new asphalt paved surfaces.

1.02 REFERENCES

A. Conform to Section 203 and 302 of the Standard Specifications for Public Works Construction.

B. Comply with International Slurry Surfacing Association (ISSA) performance guidelines.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.04 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications Section 203-9, “SEALCOAT – ASPHALT BASED”.

B. Obtain materials from same source throughout.

C. Schedule a pre-construction conference at jobsite in advance of beginning of Work. In existing areas to be seal coated and restriped, document existing striping to be duplicated before commencing seal coating work.

D. Review and resolve conflicts involving requirements of specifications. Record discussions and furnish copies to all attendees.

E. Beginning of Work means Contractor accepts all conditions.

F. Agitate bulk materials during transport.

1.05 REGULATORY REQUIREMENTS

A. Comply with local air quality management district regulations for emissions maximums.

B. Maintain control of vehicular and pedestrian traffic during seal coating operations as required for other construction activities and in accordance with local traffic authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Seal Coat: The materials for sealcoat shall conform to Section 203-9 – "Sealcoat – Asphalt Based" of the Standard Specifications. Before incorporation in the Work, the Contractor shall submit a 2 Liter (2-quart) sample of undiluted seal coat at no cost to the Owner.

1. Seal Coat: Provide one of the following surface seals:

Product Name	Manufacturer
GuardTop	Vulcan Materials Company
Over Kote	Diversified Asphalt Product
Park Top	Western Colloid Products
Sure Seal	Asphalt Coating Engineering
MasterSeal	SealMaster Pavement Products & Equipment

B. Crack Sealing: Crack sealant shall be CalSeal Modified Asphalt joint sealant as manufacturered by Henry Inc, Crafco Polyflex Type 3 or equal.

PART 3 - EXECUTION

3.01 REPAIRING AND SEALCOATING OF SURFACES

A. Preparation of Surfaces:

1. Before placing the sealcoat, the pavement surface shall be cleaned by sweeping, flushing or other means necessary to removal all loose particles of paving, all dirt, and all other extraneous material. This shall include vegetation in pavement cracks and between pavement and curb/gutter. Prior to removal an approved herbicide, which leaves behind a visible blue marker dye, shall be sprayed where vegetation exists. Surface contaminates, grease or oil spots shall be cleaned to allow for proper adhesion.

2. Prior to applying sealcoat material, cracks wider then 1/8 inch shall be cleaned, treated with weed killer, and filled with an asphalt-based crack filler (large cracks may require several applications). For best quality, it is recommended that all broken asphalt be removed and patched with new asphalt. It is also suggested that extreme low spots be filled with new asphalt. New asphalt must cure 30 days before application of sealcoat.

3. Immediately before commencing the sealcoat operations, all surface metal utility covers (including survey monuments) shall be protected by thoroughly covering the surface with an appropriate adhesive and oiled or plastic paper. No adhesive material shall be permitted to cover, seal or fill the joint between the frame and cover of the structure. A vertical tab shall be placed on each cover for locating after the seal application is complete. The tab shall extend at least 3" above the existing pavement surface. Covers are to be uncovered and cleaned of asphalt emulsion material by the end of the same work day. Inspector shall inspect surfaces before the installation of seal coat.

4. For best results, the asphalt, just prior to being sealed, should be sprayed with a mist of water in an amount that will leave the surface damp but with no puddles or visible water. This procedure is critical when ambient temperature is hot with bright sunlight or when the pavement is excessively aged or porous.

5. A prime or tack coat may be necessary on surfaces that have weathered excessively or are dusted. The primer should be diluted with three parts clean, potable water and one part SS-1h emulsion and shall be applied at the rate of 0.05 gallon per square yard.

6. Install barricades as required to divert traffic from operations. Install temporary "no parking" signs and similar notices.

B. Application:

1. Sealcoat may be mixed with water to obtain desired consistency for job requirements to a maximum of 20% of the total volume. Care should be taken not to over dilute. Material after dilution shall be mixed with a mechanical agitator to maintain consistency and ease of application. Note that as the pavement increases in roughness, the amount of dilution should be decreased.

2. Sealcoat shall only be applied when the atmospheric temperature is greater than 55 degrees F and if rain is not forecast for the period of 24 hours after application.

3. The sealcoat material shall be applied in two applications. Unless otherwise specified, the total quantity applied (before dilution) shall be 50 gallons per 1,000 square feet.

4. Sealcoat material shall be applied using a truck-mounted tank or wheeled container in continuous parallel lines and spread by means of brooms or rubber-faced squeegees either by hand or machine and in such a manner as to eliminate all ridges, lap marks, and air pockets.

5. Hand tools shall be available in order to remove spillage. Ridges or bumps in the finished surface will not be permitted. Sealcoat material

shall be homogeneous prior to spreading, with no visible separation of solids and liquids.

6. When the first coat has completely dried to the touch, apply the second coat. While misting is not normally required before second coat, surface should be clean with no foreign materials on it.

C. Drying Time:

1. Sealcoat should be allowed to dry 24 – 48 hours before permitting traffic. When asphalt is cold or in shade, or air temperature is below 75 degrees F, based on general weather, humidity and temperature conditions, drying time may need to be extended.

3.02 CLEAN UP

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

B. Striping for parking or traffic flow should be done only after the sealcoat has thoroughly dried. It is recommended that a high quality water based Traffic Line Paint be used for best results.

3.03 PROTECTION

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

END OF SECTION

SECTION 32 12 93

SYNTHETIC GRASS SYSTEM

SECTION 1: GENERAL

1.0 SCOPE OF WORK:

A. It shall be the responsibility of the synthetic grass manufacturer to provide all labor, materials, equipment and tools necessary for the complete installation of the synthetic grass turf fields as indicated on the plans and as specified herein. The installation of all materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.

B. Perimeter edge details required for the system shall be as detailed and recommended by the Manufacturer, and as approved by the Owner. Supply and installation of these details and the entire sub-surface base drainage system will be under the scope of work of the general contractor, not that of the synthetic grass manufacturer / Installer.

The system shall consist of, but not necessarily be limited to, the following:

1.1 A vertical draining sub-base system constructed by the General Contractor per the contract drawings.

FieldTurf Elite FT-2.5" Vertex Prime synthetic turf with CoolPlay
Owner to purchase direct under separate contract.
Fieldturf and its installation are not part of this bid.

2.0 GENERAL CONTRACTOR QUALIFICATIONS

A. Installers of the subsurface drainage base system for the fields shall be required to comply with and supply proof/references to the Owner 10 days prior to the bid the following information:

1. General Contractor constructing the drainage base system must have an installation team possessing a Class A California Engineering Contractor's License.

2. Have prior direct experience in preparing a minimum of 20 drainage base sub-surface systems for synthetic turf sports fields as is proposed for this project and must have installed a minimum of 20 synthetic turf field projects the past 3 years in California.

SECTION 3: SYNTHETIC TURF MATERIAL

3.0

FieldTurf Elite FT- 2.5" Vertex Prime synthetic turf CoolPlay.
Phone: 858-353-2366
Fieldturf and its installation will be purchased direct via separate CMAS contract.

4.0 FIELD MARKINGS

4.2 Soccer: as shown on the contract drawings. Color shall be yellow, except where noted.

Side lines
End lines
Goal Box
6-yard box
Corner Kick markings

Center Circle markings
Penalty Kick Markings

4.3 If applicable, the center field logo will be inlaid according to artwork submitted by the Architect to Fieldturf, (at least two months in advance of field installation commencement), subject to the availability of colors.

4.4 If applicable, endzone letters per contract drawings.

4.5 Architect shall provide the Turf Manufacturer with final electronic versions of artwork and all Pantone Matching System color codes at least two (2) months in advance of field installation commencement.

5.0 CLEANING RECOMMENDATIONS

5.1 Protect installed FieldTurf from subsequent construction operations.

5.2 Do not permit traffic over unprotected floor surface.

5.3 General Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

5.4 All usable remnants of new material shall become the property of the owner.

5.5 General Contractor shall keep the area clean throughout the project and clear of debris. Surfaces, recesses, enclosures, etc., shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

6.0 PROJECT CLOSEOUT

6.1 FieldTurf to supply a field groomer, which shall include a towing mechanism compatible with a field utility vehicle. The field groomer shall be model GroomRight or approved (by Manufacturer) equal.

6.2 FieldTurf to supply a field sweeper, which shall include a towing mechanism compatible with a field utility vehicle. The field sweeper shall be the FieldSweep or approved (by Manufacturer) equal.

6.3 FieldTurf will train the Owner's facility maintenance staff in the use of the Turf Manufacturer's recommended Groomer & Sweeper within three (3) months after completion of the installation process.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the Contract Documents.

B. The following types of concrete shall be covered in this Section:

1. Portland cement concrete pavement, cement walks, flatwork, curbs, gutters, retaining curbs, swales, trash pick-up areas, ramps, mowing strips, fence post footings, sliding gate concrete, catch basins, pipe bedding and encasements, transition structures, flagpoles and light standard bases and footings, splash blocks and equipment pads.

2. Portland cement concrete paving shall be stable, firm and slip resistant and shall comply with CBC sections 11B-302 and 11B-403.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference specifications of the GENERAL REQUIREMENTS.

B. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction (“GREENBOOK”), 2021 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the “Standard Specifications” and the 2019 California Building Code.

C. Comply with the current provisions of the following Codes and Standards.

1. Federal Specifications:

a. UU-B-790A (Int.Amd. 1) Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).

2. Commercial Standards:

a. ACI 214 Recommended Practice for Evaluation of Strength Test Results of Concrete.

b. ACI 301 Specifications for Structural Concrete for Buildings.

c. ACI 315 Details and Detailing of Concrete Reinforcement.

d. ACI 318-14 Building Code Requirements for Reinforced Concrete.

e. ACI 347 Recommended Practice for Concrete Formwork.

f. ACI 350 Recommended Practice for Sanitary Structure.

g. ASTM C 31 Practices for Making and Curing Concrete Test Specimens in the Field.

h. ASTM C 33 Specification for Concrete Aggregates.

i. ASTM C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens.

j. ASTM C 40 Test Method for Organic Impurities in Fine Aggregates for Concrete.

k. ASTM C 42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

l. ASTM C 78 Specification for Flexural Strength.

m. ASTM C 88 Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.

n. ASTM C 94 Specification for Ready-Mixed Concrete.

o. ASTM C 114 Method for Chemical Analysis of Hydraulic Cement.

p. ASTM C 131 Test Method for Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

q. ASTM C 136 Method for Sieve Analysis of Fine and Coarse Aggregate.

r. ASTM C 143 Test Method for Slump of Portland Cement Concrete.

s. ASTM C 150 Specification for Portland Cement.

t. ASTM C 156 Test Method for Water Retention by Concrete Curing Materials.

u. ASTM C 157 Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.

v. ASTM C 172 Specification for Sampling Fresh Concrete.

w. ASTM C 192 Method of Making and Curing Concrete Test Specimens in the Laboratory.

x. ASTM C 260 Specification for Air-Entraining Admixtures for Concrete.

y. ASTM C 289 Test Method for Potential Reactivity of Aggregates (Chemical Method).

z. ASTM C 311 Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

aa. ASTM C 494 Specification for Chemical Admixtures for Concrete.

bb. ASTM C 618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

cc. ASTM C 979 Specification for Pigments for Integrally Colored Concrete

dd. ASTM D 1751 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

ee. ASTM E 119 Method for Fire Tests of Building Construction and Materials.

1.03 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with GENERAL REQUIREMENTS.

B. The following submittals and specific information shall be provided.

1. Mix Designs: Prior to beginning the WORK, the CONTRACTOR shall submit to the ENGINEER, for review, and approval, preliminary concrete mix designs for each class and type of concrete specified herein. The mix designs shall be designed by an independent testing laboratory acceptable to the ENGINEER. All costs related to such mix design shall be borne by the CONTRACTOR.

a. Each concrete mix submittal shall contain the following information:

1) Slump on which the design is based.

2) Total gallons of water per cubic yard.

3) Brand, type, composition and quantity of cement.

4) Brand type, composition and quantity of fly ash.

5) Specific Gravity and gradation of each aggregate.

6) Ratio of fine to total aggregate per cubic yard.

7) Weight (surface dry) of each aggregate per cubic yard.

8) Brand, type, and ASTM designation, active chemical ingredients and quantity of each admixture.

9) Copy of the Building and Safety Research Report Approval for each concrete admixture.

10) Air content.

11) Compressive strength based on 7 day and 28 day compression tests, including standard deviation calculations, corroborative data (if applicable), and required average comprehensive strength per ACI 318, Section 5.

12) Time of initial set.

13) Certification stamp and signature by a Civil or Structural engineer registered in state of California.

14) Certificate of Compliance for Cement.

2. Certified Delivery Tickets: Where ready-mix concrete is used, the CONTRACTOR shall provide certified weighmaster delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the public weighmaster's signature, and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

3. When a water reducing admixture is to be used, the CONTRACTOR shall furnish mix designs for concrete both with and without the admixture.

4. The CONTRACTOR shall furnish a Certificate of Compliance signed by the supplier identifying the type of fly ash and stating that the fly ash complies with ASTM C 618 and these Specifications, together with all supporting test data prior to the use of the fly ash the sample represents. The supporting data shall also contain test results confirming that the fly ash in combination with the cement and water to be used meets all strength requirements and is compatible with air-entraining agents and other admixtures.

5. The CONTRACTOR shall submit to the ENGINEER for review the design mix for fly ash concrete together with the design mix for portland cement (non-fly ash) concrete as specified in this Section.

1.04 QUALITY ASSURANCE

A. Testing for Portland Cement Concrete shall be sampled and tested in accordance with the ASTM and California Tests listed in the Standard Specifications for Public Works Construction, 2015 Edition, Section 201-1.1.5.

B. Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

C. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the CONTRACTOR.

D. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the Owner, and the CONTRACTOR shall provide assistance and facilities to the INSPECTOR in obtaining samples, and disposal and cleanup of excess material.

E. Curbs and gutters shall be staked by a Land Surveyor licensed to practice in the State of California.

F. Job Mock-Up

1. General

a. Make samples on-site; revise as required; obtain Architect's approval, 10 days prior to casting finished work.

b. Finished work to match approved samples.

c. Approved sample may be incorporated into the work. Retain samples until completion of all concrete work.

d. Include typical tooled joint control in sample.

2. Broom Finished Concrete; Exterior Flatwork: Provide sample, 20 s.f. minimum area.

3. “Sacked” Vertical Surface; Exterior Wall: Provide sample, 5 sf. minimum area.

G. Construction Tolerances: The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where

tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 347.

H. Construction tolerances shall not violate dimensions, grades, slopes required by CBC for accessibility requirements. Adjust work accordingly to comply with requirements.

I. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/8-inch; In 20 feet or more: 1/4-inch
Variation from the level or from the grades shown.	In 10 feet: 1/8-inch; In 20 feet or more: 1/4-inch
Variation from the plumb	In 10 feet: 1/8-inch; In 20 feet or more: 1/4-inch
Variation in the thickness of slabs and walls.	Minus 1/8-inch; Plus 1/4-inch
Variation in the locations and sizes of slabs and wall openings.	Plus or minus 1/8-inch

PART 2 - PRODUCTS

2.01 CONSTRUCTION MATERIALS

A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials furnished for the work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.

C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.

D. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces. Conform to Section 303-5.2 of the Standard Specifications.

1. Use flexible or curved forms for curves of a 100-foot or less radius.

E. Reinforcing Materials: As follows:

1. Steel Reinforcing Bars: ASTM A 615 deformed grade 40 billet steel, plain finish, unless otherwise specified on Construction Document. Fabrication, sampling and jobsite handling shall conform to the requirements in ASTM Designation: D 3963, except the 2 samples shall be 30 inches long.

2. Dowels:

   a. Dowel bars shall be plain round smooth conforming to the requirements in ASTM Designation: A 615/A 615M, Grade 40 except that the two samples required in ASTM Designation: D 3963/D 3963M shall be 18 inches long. Dowel bars shall be free from burrs or other deformations detrimental to free movement of the bars in the concrete

   b. Dowel bars shall be lubricated with a bond breaker over the entire bar. A bond breaker application of petroleum paraffin based lubricant or white-pigmented curing compound shall be used to coat the dowel bars completely prior to placement. Oil and asphalt based bond breakers shall not be used. Paraffin based lubricant shall be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal. Paraffin based lubricant shall be factory applied. White pigmented curing compound shall conform to the requirements of ASTM Designation: C 309, Type 2, Class A, and shall contain 22 percent minimum nonvolatile vehicles consisting of at least 50 percent paraffin wax. Curing compound shall be applied in 2 separate applications, the last application not more than 8 hours prior to placement of the dowel bars. Each application of curing compound shall be applied at the approximate rate of one gallon per 15 square yards.

3. Epoxy for bonding tie bars and dowel bars to portland cement concrete shall be a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C 881, Type V, Grade 3 (Non-Sagging), Class B or C. The class used shall be dependent on the internal temperature of the hardened concrete at the time the epoxy is to be applied. Class B shall be used when the internal temperature is from 40 °F to 60 °F. Class C shall be used when the internal temperature is above 60 °F, but not higher than recommended by the manufacturer. A copy of the manufacturer's recommended installation procedure shall be provided to the Engineer at least 7 days prior to the start of work. Epoxy shall be applied in conformance with the manufacturer's recommendations.

   a. Simpson Strong-Tie Set-XP Epoxy Adhesive (or approved equal) ICC-ES ESR-2508.

F. Concrete Materials: As follows:

1. Cement shall be standard brand portland cement conforming to ASTM C 150 for Type II. Portland cement shall contain not more than 0.60 percent

alkalies. The term "alkalies" referred to herein is defined as the sum of the percentage of sodium oxide and 0.658 times the percentage of potassium oxide (Na20 + 0.658 K20). These oxides shall be determined in accordance with ASTM C 114. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the ENGINEER. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports for each shipment of cement to be used shall be submitted to the INSPECTOR.

2. Concurrent with strength design criteria, concrete shall also be proportioned to provide the requisite durability to satisfy the exposure conditions imposed by either environment and/or service. Durability, in this context, refers to the ability of the concrete to resist deterioration from the environment or service in which it is placed. Concrete proportioned in accordance with ACI 318, chapter 4, Durability Requirements, will meet this criteria.

3. Combined Aggregate: 1" maximum coarse aggregate size conforming to Grading C of Standard Specifications Section 201-1.3.2(A). Aggregates shall be obtained from pits acceptable to the INSPECTOR, shall be non-reactive, and shall conform to ASTM C 33.

4. Water: Shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies.

5. *"Pea gravel" mix is not acceptable,* unless specifically approved in writing by the Civil Engineer of Record prior to construction.

G. Admixtures:

1. The ENGINEER may require the use of admixtures or the CONTRACTOR may propose to use admixtures to control the set, effect water reduction, and increase workability. In either case, the addition of an admixture shall be at the CONTRACTOR's expense. The use and continued use of an admixture shall be approved by the ENGINEER. Admixtures specified herein, other than calcium chloride, shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used. Admixtures shall contain no free chloride ions, be non-toxic after 30 days, and shall be compatible with and made by the same manufacturer as the air entraining admixture.

2. These admixtures shall not be used in greater doses than those recommended by the manufacturer or permitted by the ENGINEER. The permitted dosage of the admixture shall not exceed that which will result in an increase in the driving shrinkage of the concrete in excess of 20

percent when used in precast or prestressed concrete, or 10 percent when used in any other structural concrete. The strength of concrete containing the admixture in the amount of proposed shall, at the age of 48 hours and longer be not less than that of similar concrete without the admixture. The admixture shall not adversely affect the specified air content, unless permitted by the ENGINEER.

3. Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture such as [Sika Chemical Corporation's Plastiment], [Master Builder's Pozzolith 300R], or equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a set accelerating admixture such as [Sika Chemical Corporation's Plastocrete 161FL], [Master Builder's Pozzolith 50C], or equal shall be used.

4. Low range water reducer shall conform to ASTM C 494, Type A. It shall be either a hydroxylated carboxylic acid type or a hydroxylated polymer type. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.

5. High range water reducer shall be sulfonated polymer conforming to ASTM C 494, Type F or G.

    a. If the high range water reducing agent is added to the concrete at the batch plant, it shall be second generation type, [Daracem 100, as manufactured by W.R. Grace & Co.]; [Pozzolith 430R, as manufactured by Masterbuilders]; or equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified.

    b. If the high range water reducer is added to the concrete at the job site, it shall be used in conjunction with a low range water reducer and shall be [Pozzolith 400N and Pozzolith MBL82, as manufactured by Masterbuilders]; [WRDA 19 and WRDA 79, as manufactured by W.R. Grace & Co.]; or equal. Concrete shall have a slump of 3-inches ± 1/2-inch prior to adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

6. Air-entraining agent meeting the requirements of ASTM C 260, shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 4 percent; provided that, when the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the total air content provided shall be 5 to 6 percent. The Owner reserves the right, at any time, to sample and test the air-entraining agent

received on the job by the CONTRACTOR. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.

7. Calcium Chloride: Except as otherwise provided herein, calcium chloride will not be permitted to be used in concrete.

8. Fly ash/pozzolan shall conform to ASTM C 618 and the following supplementary requirements:

   a. Class F fly ash

o Loss on ignition,	maximum 4 percent
o S03 content,	maximum 3 percent
o Moisture content,	maximum 1 percent

   b. Class F fly ash, as a percent by weight of total cementitious material, shall not exceed 15 percent.

   c. When Sulfate Resistant or Special Exposure Concrete is specified, test results shall be submitted to the Engineer as specified in Section 2-5.3 of the Standard Specifications. The test result shall show that the fly ash to be used is effective in contributing to sulfate resistance in conformance with ASTM C618, Table 3 (optional physical requirements) as tested in accordance with ASTM C 1012. The data submitted shall be less than 6 months old.

H. Curing Materials:

1. Concrete curing compound shall conform to the requirements of ASTM C309 Type 1-D (clear or translucent with a fugitive dye), Class B (Resin Type Only), except the loss of water shall not exceed 0.15 kilograms per square meter in 24 hours nor 0.45 kilograms per square meter in 72 hours when tested in accordance with ASTM C 156. The CONTRACTOR shall provide, when requested by the ENGINEER, certified copies of vendor's test report showing compliance with ASTM C 309 and these specifications. The testing and the report shall be supplied without cost to the Agency. All compounds shall be furnished by the CONTRACTOR in sealed original containers labeled in accordance with ASTM C 309 and with the date of manufacture.

2. Polyethylene sheet for use as concrete curing blanket shall be white and conform to ASTM C 171. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.

3. Polyethylene-coated burlap for use as concrete curing blanket shall conform to ASTM C 171. The loss of moisture, when determined in

accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

I. Expansion Joint Filler Material

1. Expansion Joint Filler: Fiber expansion joint, W.R. Meadows, or approved equal, 3/8-inch thick material conforming to ASTM D 1751.

2. Silicone Joint Sealant: Premium-grade, high-performance, moisture-cured, single-component, polyurethane-based, non-sag elastomeric sealant. Meets Federal specification TT-S-00230C. Meets ASTM C-920, Type S, Class 25 or 35; Grade NS, Use T or NT, Shore A Hardness (21 day) 35-45. A Certificate of Compliance for the silicone sealant shall be furnished to the Engineer. The Certificate shall also be accompanied with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. The Certificate and accompanying test report shall be provided for each lot of silicone joint sealant prior to use on the project.

a. Sika Corporation, Sikaflex-2C or approved equal.

J. Related Materials: As follows:

1. Damp-proofing agent shall be an asphalt emulsion, such as [Sonneborn Hydrocide 660], [Flintkote C-13-E Foundation Coating], or equal.

2. Epoxy adhesives shall be the following products for the applications specified:

a. For bonding freshly-mixed, plastic concrete to hardened concrete, [Sikadur Hi-Mod Epoxy Adhesive, as manufactured by Sika Chemical Corporation]; [Concresive 1001-LPL, as manufactured by Adhesive Engineering Company]; or equal.

b. For bonding hardened concrete or masonry to steel, [Colma-Dur Gel], [Sikadur Hi-Mod Gel], or equal.

K. Light Duty Flatwork, Curbs / Curb & Gutter Mix Design: At a minimum, concrete shall conform to the Standard Specifications for Public Works Construction, Section 201-1.1.2, mix class 520-C-2500.

1. Compressive Strength: minimum of 2,500 psi at 28 days compressive strength.

2. Slump Limit: 4 inches at point of placement.

3. Cement per cu yard (sacks): 5.5 (minimum).

4. Air Content: 4% +/- 1% percent

L. Heavy Duty Flatwork Mix Design: At a minimum, concrete shall conform to the Standard Specifications for Public Works Construction, Section 201-1.1.2 mix class 560-C-3250.

1. Compressive Strength: minimum of 3,500 psi at 28 days compressive strength.

2. Slump Limit: 4 inches at point of placement.

3. Air Content: 4% +/- 1% percent.

M. Slurry Mix Design:

1. Compressive Strength: 100 psi at min. 28 days compr. strength.

2. Slump Limit: 5 inches at point of placement.

3. Cement per cu yard (sacks): 1.0

4. Aggregate Gradation: “E” per S.S.P.W.C. table 201-1.3.2(A).

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES FOR CONCRETING

A. General: Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. Subgrade Preparation:

1. Refer to detail 1 on sheet C003 of the construction documents.

C. The compacted surface shall be firm, hard and unyielding. The term "firm, hard and unyielding" as used in S.S.P.W.C. Section 301-1.3 shall mean that when the heaviest construction and hauling equipment used on the project drives over the subgrade, no permanent deformation shall occur either before or during pavement construction. On areas where the underlying material appears to be wet or soft, or where it deflects under wheel loads, the Contractor shall employ excavation and work techniques which do not worsen the subgrade condition.

D. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual scarification or over-excavation depths will have to be determined on the basis of in-grading observations and testing performed by representatives of the project testing lab .

E. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the testing lab to verify that the over-excavation depths, shown on the construction drawings for concrete pavement structural sections, have been achieved prior to re-compaction.

F. Joints in Concrete: Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by sandblasting followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

G. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and ACCEPTED by the INSPECTOR at least 24 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

H. All inserts or other embedded items shall conform to the requirements herein.

I. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the INSPECTOR before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

J. Where concrete is to be cast against old concrete, (greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand-blasting, exposing the aggregate. In concrete shear-walls, suspended slabs and roof slabs, the interface surface at construction joints shall be roughened to a full amplitude of one quarter inch. The hardened surface shall be cleaned of all latent foreign material and washed clean, prior to the application of an epoxy bonding agent.

K. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the ENGINEER.

L. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

M. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.

N. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

O. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.02 HANDLING, TRANSPORTING, AND PLACING

A. General: Placing of concrete shall conform to the applicable requirements of ACI 301 and the requirements of this Section.

B. The total elapsed time between the addition of water at the batch plant and the completion of the discharge of the P.C.C. from the mixer shall not exceed 90 minutes. All P.C.C. remaining in the mixer after said 90-minute time limit shall be rejected and removed from the project site.

C. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the CONTRACTOR.

D. Whenever batch trucks or other paving equipment cause rutting of the subgrade or subbase in concrete placement areas, inspectors shall immediately stop construction. Construction shall not be allowed to resume until distorted subgrade or subbase is repaired. Contractors and inspectors should locate by proof rolling, any questionable unstable areas in advance to avoid distortion under equipment. Wet, unstable areas must be dried out or replaced before starting placement of asphalt. Locating wet or soft areas in advance can be accomplished by testing finished subgrade or subbase with a loaded truck. Construction of concrete pavement should not proceed unless testing gives a reasonable indication that distortions will not occur during construction of overlying pavement. When repair, aeration, and recompaction are required to correct damage from Contractor's operation, all necessary repair will be done at Contractor's expense. However, if the Engineer determines that additional depth of aeration and recompaction are needed, that should be paid by change order.

E. All pull boxes, meter boxes, valve covers and manholes shall be adjusted to proposed finish grade prior to placement of the P.C.C.

F. Dowel Placement:

1. Dowel bars shall be centered on the joint within a tolerance of ±2 inches in the longitudinal direction directly over the contact joint or sawcut for the transverse weakened plane joints, as shown on the plans. Prior to placement of dowel bars, the Contractor shall submit to the Engineer a written procedure to identify the transverse weakened plane joint locations relative to the middle of the dowel bars and the procedure for consolidating concrete around the dowel bars.

2. Dowel bars shall be placed at longitudinal joints as shown on the plans. Dowel bars shall be placed as shown on the plans by using mechanical insertion. When dowel bars are placed by mechanical insertion, the concrete over the dowel bars shall be reworked and refinished so that there is no evidence on the surface of the completed pavement that there has been any insertion performed. When drill and bonding of dowel bars is performed at contact joints, a grout retention ring shall be used.

G. Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the project inspector, all subject to the observation of the engineer or architect.

H. Casting New Concrete Against Old: An approved epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where waterstop is installed.

I. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the INSPECTOR. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

J. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the pour. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

K. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily

temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.

L. Cold Weather Placement: Earth foundations shall be free from frost or ice when concrete is placed upon or against them. Fly ash concrete shall not be placed when the air temperature falls below 50 degrees F.

M. A transverse construction joint shall be constructed, including dowel bars, at the end of each day's work or where concrete placement is interrupted for more than 30 minutes, to coincide with the next contraction joint location. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of excess concrete shall be at the Contractor's expense. Excess material shall become the property of the Contractor and shall be disposed of. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of dowel bars.

N. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. The finished surface shall be free from humps, sags, blemishes or other irregularities Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

O. Broom Finish Type:

1. Surfaces Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.

2. Surfaces Sloped greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3. Asphalt Paving and other Concrete Paving finishes along the Accessible Route of Travel shall be Slip Resistant.

P. Joints:

1. Joints: Joints in concrete curb, gutter and flatwork shall be designated as expansion joints and control joints. Joints for concrete flatwork shall be provided in spacing noted on the architectural plans. Expansion joints for curbs / curb & gutter shall be placed at no greater than 15 feet on center or as indicated on construction drawings.

a. Expansion Joints: Provide premolded joint filler, material meeting Section 2.01-I herein.

1) Extend expansion joint fillers full-width and depth of joint, and 1/4" below finished surface where joint filler is indicated. If no joint sealer is called for, place top of premolded joint filler flush with top of concrete or curb.

2) Where silicone joint sealer is noted on the construction documents, the premolded joint filler strips shall be placed 1” below the surface of the concrete or curb, the full width of the expansion joint. The remainder of all joints shall be filled to within 1/4” below the surface of the concrete with the silicone joint sealant.

3) Provide expansion joint filler strips, with elastomeric sealer, between p.c.c. walk and curb, p.c.c. walk and buildings, & p.c.c. walk and retaining walls and at locations noted on the construction documents. The depth of the filler strip shall be the depth of the p.c.c. walk plus 1 inch with the top set flush with the specified grade of the top of curb or walk.

b. Control Joints:

1) Control joints in site work concrete shall comply with details on sheet C005.

Q. Protection: In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control film. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

3.03 LIGHT STANDARD BASES, FLAGPOLE BASES, POST BASES AND SIMILAR SITE STRUCTURES

A. Forms: Suitable material and type, size, shape, quality and strength to insure construction as designed, true to line and sufficiently rigid to resist deflection during placing of concrete. Clean forms of all dirt, mortar and foreign matter before use.

B. Reinforcement: Place accurately and hold in position, using metal chairs, spacers, metal hangers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of mortar, oil, dirt, loose mill scale loose or thick rust and coatings.

C. Coordinate installation of conduits, cast in place items and other inserts.

D. Finish: Grind or sack as required as determined by the Architect to produce a smooth, straight, plumb and acceptable finish without burrs or form marks. For horizontal surfaces: provide float finish.

E. Curing: Cure surfaces utilizing one of the following methods:

1. Spraying: Spray water over slab areas and maintain wet for 7 days.

2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.

3. Apply liquid curing compound at rate of 200 square feet per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units or finish of any kind.

3.04 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be high speed power vibrators (8000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.

B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.05 CURING

A. Comply with 2019 California Building Code, Title 24, Part 2, Volume 2, Section 1905A.11.

1. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by curing as herein specified.

1. Provide moisture-curing by the following methods:

a. Keep concrete surface continuously wet by covering with water.

b. Continuous water-fog spray.

c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.

2. Provide curing and sealing compound to exposed exterior slabs, walks, and curbs, as follows:

a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid, floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

C. Concrete slabs and paving shall be properly cured and protected against damage and defacement of nature during construction operations. If weather is hot or surface has dried out, spray surface with fine mist of water starting not later than two hours after final troweling. Surface of finish shall be kept continuously wet for at least ten days. Wetting is considered emergency work and shall be performed on weekends and holidays if necessary.

D. The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which,

for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense. Exclude traffic from concrete paving for at least 7 days after placement.

E. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

3.06 PUMPING OF CONCRETE

A. General: If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment: The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the site during pumping.

C. The minimum diameter of the hose (conduits) shall be 4-inches.

D. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced.

E. Aluminum conduits for conveying the concrete will not be permitted.

F. Proportioning: Minimum compressive strength, cement content, and maximum size of aggregates shall be as specified herein.

G. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible.

H. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.

I. Water and slump requirements shall conform to the requirements of this Section.

J. Cement and admixtures shall conform to the requirements of this Section.

K. Field Control: Concrete samples for slump per ASTM C 143 and test cylinders per ASTM C 31 and C 39.

3.07 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the ENGINEER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes,

honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced.

1. All repairs and replacements herein specified shall be promptly executed by the CONTRACTOR at its own expense.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair purposes shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with non-shrink grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with non-shrink grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

E. Prior to filling any structure with water, all cracks that may have developed shall be repaired to the satisfaction of the ENGINEER. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired as specified herein.

F. The finished surface shall be free from humps, sags, blemishes or other irregularities.

3.08 FIELD QUALITY CONTROL

A. Correction of Mix Design for Failed Concrete Tests: If the compressive cylinder strength test for in place PCC yields test results below the specified 28-day PCC compressive strength and the Engineer determines a corrective change is necessary, the Contractor shall, at its own expense, make corrective changes in

the mix proportions. The Engineer shall approve the changes in the mix proportions or PCC placement procedures, before any additional PCC is placed on the job.

B. Flood Tests: Before final acceptance, and after concrete has thoroughly cured, all concrete pavement, including swales and curb & gutter, shall be water tested to ensure proper drainage as directed by the Inspector. The Contractor shall provide water for this purpose. The flooding shall be done by water tank truck. Concrete work where water ponds and does not run off in a reasonable amount of time (1-hour), shall be removed to the nearest score or joint line and replaced to provide proper drainage. Full compensation for complying with this requirement shall be considered as included in the Contract Unit Price for cement concrete pavement.

3.09 CARE AND REPAIR OF CONCRETE

A. General: The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense.

B. The contractor shall barricade and protect placed Portland Cement Concrete from all damage, marks, mars and/or graffiti. Any Portland Cement Concrete damaged, defaced, discolored or defective shall be replaced at the contractor’s expense.

END OF SECTION

SECTION 32 17 13

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 REFERENCE:

A. Related Sections:

1. Section 32 12 16: Asphalt Paving.

1.02 DESCRIPTION:

A. Principal Work Items Are:

1. Painted lines, lettering, and symbols at parking areas.

2. Painted stripes at exterior stairs.

3. Fire Lane “No Parking.”

4. Curb marking and red curbs.

1.03 JOB CONDITIONS:

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

B. Sequencing, Scheduling: Coordinate with paving work. Verify that paint type is compatible with asphalt paving surfaces seal coats.

C. Protection: Do not apply pavement markings for seven days after application of asphalt surface seal coat. After application, protect from traffic until thoroughly dry.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Traffic Paint:

1. Type: Water base, roadway traffic lane marking type; colors as selected.

2. Acceptable Manufacturers:

a. Dunn-Edwards, Vin-L-Stripe No. W-801, vinyl-epoxy as a standard of quality.

b. J. E. Bauer latex base Formula No. 1030A9 White, No. 1056A9 Yellow, No. 1865A9 Blue, No. 1118A9 Green, and No. 1854A9 Red.

c. Sinclair No. 160 Vinyl Traffic Line Paint, water base.

d. Ennis Traffic Safety Solutions.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Layout: Accurately measure and layout work. Use stencils for all work; snap lines for straight work.

B. Prior to application of paint, allow the pavement to properly cure. Clean and prepare in accordance with paint manufacturer's written recommendations.

C. Provide mechanical equipment to install paint in a uniform, straight or curved pattern, without holidays and other defects.

D. Do not permit traffic until paint has completely cured.

E. Provide two installations/applications of pavement marking; once for initial use and once after final seal coat.

F. Install 2 coats in thickness recommended by manufacturer.

3.02 APPLICATION:

A. Painted Lines, Lettering, and Symbols At Parking Areas:

1. Parking Stall Lines: 4 inches wide, color white.

2. Access aisles for accessible parking spaces shall be marked by a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36” on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings may extend beyond the minimum required length. CBC Section 11B-502.3.3.

3. Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around the perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36” on center in a color contrasting with that of the aisle surface. CBC section 11B-503.5.

4. Color: White, for all work except blue at wheelchair accessible parking stalls borders and red at Fire Lanes.

5. Specific areas designated as fire lanes must be marked with red curbs using OSHA safety red paint. “FIRE LANE – NO PARKING” shall be painted on the top of curb in 3” white lettering at a spacing of 30’ on center or portion thereof.

6. Painted lines and markings on pavement at wheelchair accessible parking stalls shall be 4 inches wide (blue in color) equal of Color No. 15090 per Federal Standard 595C.

7. Detectable warnings surfaces shall comply with CBC Section 11B-705.1.

8. Detectable warning surfaces shall be yellow conforming to FS 33538 of Federal Standard 595C, except for locations at curb ramps, islands, or cut-through medians where color used shall contract visually with that of adjacent walking surfaces, either light-on-dark, or dark-on-light. CBC Sections 11B-705.1.1.3 and 11B-705.1.1.5.

9. Provide a minimum 5 year warranty on detectable warning surfaces per DSA Bulletin 10/31/02, revised 04/09/08.

B. Stripes At Exterior Stairs:

1. Stripes: 2" wide, located 2" from, and parallel to, nosing.

2. Required Locations: All treads, all top landings, all intermediate landings.

END OF SECTION

SECTION 32 17 26

SURFACE APPLIED TACTILE/DETECTABLE WARNING TILE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface Applied tactile tile modules where indicated.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.

B. Samples for Verification Purposes: Submit two tile samples minimum 6" by 8" of kind proposed for use.

C. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on Surface Applied tactile tile system as certified by a qualified independent testing laboratory.

E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

1.03 QUALITY ASSURANCE

A. Provide Surface Applied tactile tiles and accessories as produced by a single manufacturer.

B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces that comply with detectable warnings on walking surfaces section of Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES.

D. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR). Title 24, Part 1, Articles 2, 3 and 4 and Part 2, Section 205 definition of "Detectable Warning". Section 11B-705.1.2.2 for "Curb Ramps" and Section 11B-705.1.2.5 for Hazardous Vehicle Areas".

E. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Section 11B-705.1.
   1. Detectable warning surfaces at transit boarding platform edges, bus stops, hazardous vehicular areas, reflecting pools and track crossing shall be yellow and approximate AMS Standard 595A Color No. 33538. Detectable warning surfaces shall be color of AMS Standard 595A Color No. 33538 or a color providing a 70% minimum visual contrast with that of adjacent walking surfaces. The material used to provide visual contrast shall be an integral part of the surface. CBC Section 11B-705.1.1.3
   2. Detectable warning surfaces shall differ from adjoining surfaces in resiliency and or sound-on-cane contact. Such constraint shall not be required for detectable warning surfaces at curb ramps, islands, or cut-through medians. CBC Section 11B-705.1.1.4.
   3. Truncated Domes: provide raised Detectable Warnings with diameter of 0.90” min. to 0.92" max. at base tapering to 0.45" min. to 0.47" max. at top, height of 0.20" and base-to-to base spacing of 0.65" min. measured between the most adjacent domes on a square grid (in-line pattern).
      a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.

1.04 DELIVERY, STORAGE AND HANDLING

A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.

B. Tiles shall be delivered to location at building site for storage prior to installation.

1.05 SITE CONDITIONS

A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40°F in areas where work is completed.

B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.

C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.

D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

1.06 EXTRA STOCK

A. Deliver extra stock to storage area designated by engineer. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for Surface Applied tactile tiles. Furnish not less than two (2) percent of the supplied materials for each type, color and pattern installed.

1.07 WARRANTY (DETECTABLE WARNINGS AND DIRECTIONAL TEXTURE)

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detectable warnings and directional surface products that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly.
      b. Degrade significantly means that product maintains at least 90 percent of its approved design characteristics, as determined by the authority having jurisdiction.
   2. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Engineered Plastics Inc, Armor Tile.
   2. ADA Solutions, Inc., North Billerica, MA.

B. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Section 11B-705 and the California Accessibility Reference Manual.
   1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.90" min. to 0.92" max. at base tapering to 0.45" min. to 0.47" max. at top, height of 0.20" and base-to-to base spacing of 0.65" min. measured between the most adjacent domes on a square grid (in-line pattern).
      a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.
   2. Detectable Warning Texture (Truncated Domes): Plastics/Composites: Armor Tile, ADA Tactile Systems by Engineered Plastics Inc., or equal.

C. The Vitrified Polymer Composite (VPC) Surface Applied Tactile Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.

D. Color: Yellow conforming to Federal Color No. 33538 of AMS Standard 595A. Color shall be homogeneous throughout the tile.

2.02 MATERIALS

A. Fasteners: Color matched, corrosion resistant, flat head drive anchor: 1/4" diameter x 1- 3/4" long, or manufacturer's recommended fasteners.

B. Adhesive and Sealant: Manufacturer's standard.

PART 3 - EXECUTION

3.01 INSTALLATION

A. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.

C. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Architect.

D. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. Use thin permanent marker. Remove tile when done marking its location.

E. The surface to receive the detectable warning surface tile (not recommended for asphalt) is to be mechanically cleaned with diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a rag soaked in Acetone.

F. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for minimum of 30 days.

G. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.

H. Apply the adhesive on the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2" width of the adhesive locator. A 3 x 4 foot tile will typically require an entire tube of adhesive.

I. Set the tile true and square to the curb ramp area as detailed in the design drawings.

J. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3½" using the recommended diameter bit. Drill through the tile without hammer option until the tile has been successfully penetrated, and then with hammer option to drill into the concrete.

K. Immediately after drilling each hole, and while still applying foot pressure, vacuum, brush or blow away dust and set the mechanical fastener as described below, before moving on to the next hole.

L. Mechanically fasten tiles to the concrete substrate using a hammer to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the hammer, taking care to avoid any inadvertent blows to the truncated dome or tile surface. A plastic deadblow or leather hammer is recommended.

M. Working in a sequence that will prevent buckles in the tile, proceed to drill and install all fasteners in the tile's molded recesses.

N. Following the installation of the tiles, the perimeter caulking sealant should be applied. Follow the perimeter caulking sealant manufacturer's recommendations when applying. Tape all perimeter edges of the tile and also tape the adjacent concrete back 1/2" from the tile's perimeter edge. Tool the perimeter caulking with a plastic applicator or spatula to create a straight edge in a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.

O. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking.

P. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other, in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.

Q. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is advisable. All cuts should be made prior to installation of the tiles.

R. If installing adjacent tiles, care should be taken to leave a 1/8 inch gap between each. If tiles are custom cut to size, and if pre-molded recesses (to receive fasteners) are removed by the cut, then any truncated dome can be center-drilled with a ¼ inch through hole, and countersunk with a suitable bit, to receive mechanical fasteners. New holes should be created no closer to the edge of the tile than any of the other perimeter fastener pre-molded recesses. Care should be taken to not countersink too deeply. Fasteners should be flush with the top of the truncated dome when countersunk properly.

S. Adhesive or caulking on the surface of the Tile can be removed with Acetone.

3.02 CLEANING AND PROTECTING

A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by methods recommended by manufacturer.

END OF SECTION

SECTION 32 18 39

SYNTHETIC TRACK SURFACING

Part 1 – General

1.1 Scope

A. The synthetic surfacing contractor shall furnish all labor, materials, equipment, supervision and services necessary for the proper completion of the **BSS 300** Synthetic Track Surfacing System and related work indicated on the drawings and specified herein.

B. Basis of design is the Beynon BSS 300 or approved equal.

C. Contact: Mason Farnsworth
4668 N. Sonora Ave. Suite 101, Fresno, CA 93722
Phone: 559-237-2590
Email: mfarnsworth@beynonsports.com

D. Equals are to be approved by addendum only, 7 days prior to bid date. Equals must submit data and samples per Section 3.1 Quality Assurance.

E. The synthetic surfacing contractor shall refer to the drawings for the required locations of synthetic track surfacing to be installed. All quantities and dimensions shall be field verified by the synthetic surfacing contractor.

1.2 Specific Scope of Work

A. Install a WORLD ATHLETICS (WA) approved, impermeable polyurethane synthetic track system consisting of SBR Rubber and BEYPUR, a single-component polyurethane binder and BEYPUR, a poured-in-place, two-component U.V. stabilized elastomeric polyurethane with an embedded textured wearing layer finish.

B. Layout and paint all track lines and event markings as required and specified by owner and the applicable governing body for the specified project; either WORLD ATHLETICS (WA), NCAA or NFSHSA rules.

1.3 Coordination

A. The synthetic surfacing contractor shall coordinate the work specified with an authorized and appointed representative of the owner so as to perform the work during a period and in a manner acceptable to the owner.

Part 2 – Codes and Standards

2.1 Applicable Publications

A. Codes and standards follow the current guidelines set forth by the WORLD ATHLETICS (WA), the National Collegiate Athletic Association (NCAA) and the National Federation of State High School Associations (NFSHSA), along with the current material testing guidelines as published by the American Society of Testing and Materials (ASTM).

2.2 Performance Standards

The BSS 300 synthetic track surfacing system shall exhibit the following minimum performance standards as required by WORLD ATHLETICS (WA):

A.	Thickness:	(12-13mm) or as specified
B.	Force Reduction	35-50%
C.	Vertical Deformation:	0.6mm-2.5mm
D.	Coefficient of Friction:	≥ 0.5 (47 TRRL Scale)
E.	Tensile Strength:	≥ 0.5 Mpa
F.	Elongation:	≥ 40%

Part 3 – Quality Assurance

3.1 Contractor and Manufacturer Qualifications

A. The CONTRACTOR and the MANUFACTURER must be the same.

B. The CONTRACTOR and MANUFACTURER must have a minimum of 5 years of experience in the installation of poured-in-place, two-component elastomeric polyurethane synthetic track surfacing in the California market.

C. The CONTRACTOR shall be able to furnish evidence that they have been in business for a period of not less than 3 years, under the present name, and if required, furnish financial statements for each of the past 3 years.

D. The CONTRACTOR must have a current California contractor's license and DIR number at time of bid.

E. The CONTRACTOR must have installed a minimum of 10 outdoor track facilities in California in the last 2 years using the exact, WORLD ATHLETICS (WA) certified BSS 300 synthetic track surfacing, as specified herein with the contractor bidding this project. CA install reference form is to be included with bid and or with equal submittal request.

F. The MANUFACTURER must have a minimum of 10 years of experience with compound two-part polyurethane for athletic surfaces.

G. The CONTRACTOR is required to provide documentation that shows the selected specified and installed product meets current WORLD ATHLETICS (WA) Performance Standards for Synthetic Surfaced Athletics Tracks (Outdoor) and is certified in terms of the WORLD ATHLETICS (WA) certification system as updated to present day.

H. The MANUFACTURER must offer a minimum of seven (7) WORLD ATHLETICS (WA) Certified Track Systems.

I. All polyurethane components must be MANUFACTURED in the United States in an **ISO 9001:2015 Certified** facility to ensure the highest quality materials.

J. The CONTRACTOR/MANUFACTURER must supply a five (5) year third party insured warranty covering this project.

3.2 Submittals

The following submittals must be received during the submittal process:

A. Standard printed specifications of the synthetic track surfacing system to be installed on this project.

B. An affidavit attesting that the synthetic track surfacing material to be installed meets the requirements defined by the manufacturers currently published specifications and any modifications outlined in those technical specifications.

C. A synthetic track surfacing system sample, 4” x 6” (min.) in size, of the same synthetic track surfacing system to be installed on this project.

D. A list of completed facilities, including the installing supervisor, of the exact synthetic track surfacing system.

E. A current WORLD ATHLETICS (WA) Certificate proving the product to be installed meets the current WORLD ATHLETICS (WA) Performance Standards for Synthetic Surfaced Athletics Tracks (Outdoor).

Part 4 – Materials

4.1 Elastomeric Polyurethane

A. BEYPUR, the two-component U.V. stabilized elastomeric polyurethane compounded from polyol and isocyanate components, based on one hundred percent (100%) Methylene Diphenyl Isocyanate (MDI). No Toluene Diisocyanate Isocyanate (TDI) will be allowed.

B. The elastomeric polyurethane shall be red in color.

4.2 EPDM Granulate

A. The EPDM granulates shall be approximately 1 to 3mm in size

B. The EPDM granulates and the U.V. stabilized elastomeric polyurethane shall be color matched.

4.3 Rubber Granulate of the base course

A. Styrene Butadiene Rubber (SBR) processed ground to a graded size of 1-3mm.

B. A maximum of 82%, by weight of the paved-in-place base layer, of SBR will be allowed.

4.4 Single Component Polyurethane Binder

A. This binder shall be BEYPUR 300, a single-component polyurethane binder with a long cure time for use in paved mat specifications; a minimum of 18%, by weight of the paved-in-place base layer.

4.5 Seal Coat

A. This seal coat shall be BEYPUR 200, a two-component polyurethane pore sealer use with paved rubber granule mats. The granular SBR and binder layer shall be sealed with the BEYPUR 200. The application of EPDM dust is not allowed.

4.6 Line Marking Paint

A. All line and event markings shall be applied by experienced personnel utilizing the manufacturer's recommended pigmented paint compatible with the BSS 300 Track Surfacing material.

Part 5 – Installation

5.1 Subbase Requirements

A. Asphalt Compaction

a. The Synthetic Track Surfacing System shall be laid on an approved subbase. The General Contractor shall provide compaction test results of 92-96% for the installed subbase and asphalt surface.

b. For NCAA certification the following criteria must be followed. The track surface, i.e. asphalt substrate, shall not vary from planned cross slope by more than +/- 0.2%, with a maximum lateral slope outside to inside of 1%, and a maximum slope of 0.1% in any running direction. The finished asphalt shall not vary under a 10' straight edge more than 1/8".

c. It should be the responsibility of the asphalt-paving contractor to flood the surface immediately after the asphalt is capable of handling traffic. If, after 20 minutes of drying time, there are birdbaths evident, it shall be the responsibility of the architect, in conjunction with the surfacing contractor, to determine the method of correction. No cold tar patching, skin patching or sand mix patching will be acceptable.

B. Asphalt Quality

a. No Recycled Asphalt Pavement (RAP) shall be used in the wear course asphalt mix design as the inclusion of RAP as an off-set to virgin asphalt binder results in a brittle hot-mix asphalt (HMA) with significantly lower tensile strength and fatigue resistance. The sports surfacing contractor will not be held responsible for asphalt failures resulting from the inclusion RAP in the HMA mix design of the wear course.

b. Any oil spills (hydraulic, diesel, motor oil, etc.) must be completely removed, either by chipping out or removing and replacing with new, keyed in asphalt. The minimum depth of any asphalt replacement shall be one inch. The curing time for the asphalt base is 28 days. It shall be the responsibility of the surfacing contractor to determine if the asphalt substrate has cured sufficiently prior to the application of polyurethane surfacing system.

C. Responsibility of Others

a. It shall be the responsibility of the general contractor to determine if the asphalt substrate meets all design specifications, i.e. cross slopes, planarity and specific project criteria. After all the above conditions are met, the

synthetic surfacing contractor must, in writing, accept the planarity of the asphalt receiving base, before work can commence.

5.2 Thickness

A. The thickness of the **BSS 300** Synthetic Track Surfacing System shall be 13mm.

5.3 Equipment

A. The **BSS 300** Synthetic Track Surfacing System components shall be processed and installed by specially designed machinery and equipment. A mechanically operated paver with variable regulated speed and thermostatically controlled screed shall be used in the installation of the base mat. The wearing course shall be installed using automatic electronic portioning, which provides continuous mixing and feeding for an accurate, quality controlled installation.

B. No hand mixing is allowed.

5.4 Installation

A. Base Course

The SBR granules and BEYPUR 300 shall be mixed together on site to regulate the ratio/quantity of SBR, not to exceed 82% in the base mat portion of the system. The BEYPUR 300 shall be mixed with the SBR rubber so that a minimum of 20%, by weight, exists in the final mixture. This mixture is then mechanically installed using the paver.

B. Seal Coat

The two BEYPUR 200 components are mixed at the prescribed ratio homogeneously with a suitable mixing device. The coating is squeegee applied to the base mat, making it impermeable.

C. Wearing Course

The 1 to 3mm EPDM granules shall be integrated into the BEYPUR to achieve the full depth of the 5 mm wearing course. The resilient embedded textured finish shall be a dense matrix of exposed EPDM granules. The homogeneous wearing course shall be applied in situ with the base course. The surface color shall be Beynon Red.

5.5 Site Conditions

A. Installation shall not take place if adjacent or concurrent construction generates excessive dust, abrasives or any other by-product that, in the opinion of the installer, would be harmful to the track material, until completion of such works.

B. Apply Synthetic Track Surfacing in dry weather when pavement and atmospheric temperatures are fifty (50) degrees Fahrenheit or above, and are anticipated to remain above fifty (50) degrees Fahrenheit for twenty-four (24) hours after completing application.

C. The maximum temperature cannot exceed 105 degrees at any point during a 24 - hour period.

D. Rain cannot be falling. If there is a threat of rain, work shall cease until dry conditions can be re-established on the track pavement. Work is to proceed only when adequate curing can be guaranteed by the manufacturer.

Part 6 – Line Striping and Event Markings

6.1 Layout

A. Line striping and event markings shall be laid out in accordance with the owner and in reference to the project's governing body for current WORLD ATHLETICS (WA), NCAA and / or NFSHSA rules.

6.2 Certification

A. Upon completion of the installation, the owner shall be supplied with all necessary computations and drawings as well as a letter of certification attesting to the accuracy of the markings.

Part 7 – Guarantee

A. The BSS 300 Synthetic Track Surfacing System shall be fully guaranteed against faulty workmanship and material failure for a period of five (5) years from the date of acceptance.

B. Synthetic surfacing material found to be defective as a result of faulty workmanship and/or material failure shall be replaced or repaired at no charge, upon written notification within the guarantee period.

END OF SECTION

SECTION 32 31 13

FENCES AND GATES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fence framework, fabric, and accessories

B. Excavation for post bases.

C. Concrete anchorage for posts and center drop for gates.

D. Swing and Rolling gates, signs, and related hardware.
   1. Maunal

E. Related Sections:
   1. Section 08 71 00, Door Hardware.
   2. Division 32 for Concrete footings.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM International
   1. ASTM A 392 - Zinc-Coated Steel Chain-Link Fence Fabric
   2. ASTM A 824 - Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
   3. ASTM B221/B221M Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   4. ASTM F 552 - Terminology Relating to Chain Link Fencing
   5. ASTM F 567 - Installation of Chain-Link Fence
   6. ASTM F 626 - Fence Fittings
   7. ASTM F 900 - Industrial and Commercial Swing Gates
   8. ASTM F 1043 - Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
   9. ASTM F 1083 - Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
   10. ASTM F 1184 - Industrial and Commercial Horizontal Slide Gates
   11. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

C. SSPWC - Standard Specifications for Public Works Construction, Latest Edition

D. CLFMI - Chain Link Fence Manufacturer's Institute

E. CBC - 2019 California Building Code

1. Chapter 10, Means of Egress
2. Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
3. Chapter 19A, Concrete

F. National Ornamental and Miscellaneous Metals Association (NOMMA)
1. NOMMA Guidelines - Guideline 1 Joint Finishes

1.03 QUALITY ASSURANCE

A. Manufacturer: Company specializing in commercial quality chain link fencing with five years of experience.

B. Installer: Demonstrated successful experience installing chain link fencing on similar projects in accordance with ASTM F567 and have at least 5 years' experience.

1.04 SUBMITTALS

A. Shop drawings including plan layout, grid, spacing of components, accessories, fittings, hardware, footings, anchorages and schedule of components.

B. Product data on each specified product and accessory.

C. Certifications: Manufacturer's material certifications in compliance with current ASTM specifications.

D. Manufacturer's installation instructions.

E. Three samples illustrating each fence fabric finish.

1.05 WARRANTY

A. Provide two-year warranty to insure materials against rusting or breakdown of finish. Provide adjustments as needed to assure continued smooth operation of gates.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404.

B. The levers of lever actuated latches or locks for accessible gates shall be curved with a return to within 1/2" of the gate surfaces to prevent catching on the clothing or persons.

C. Swing doors and gate surfaces within 10" of the finish floor or ground shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plate shall be capped. CBC Section 11B-404.2.10.

2.02 MATERIALS

A. Acceptable Manufacturers
1. Any Manufacturer who is a current member of the Chain Link Fence Manufacturer's Institute.
2. Or equal in accordance with Division 01, General Requirements for substitutions.

B. Framework: ASTM F1043; Type 1 Group IA. ASTM F1083; Schedule 40 , Intermediate Strength Grade 50,000 psi, hot-dipped galvanized [with zinc protective coatings] steel pipe, minimum 1.8 oz/sq. ft., Sized in accordance with Table 206-6.2, Standard Specifications for Public Works Construction. Once piece without joints in accordance with CLFM I.
1. EXIT Gates: galvanized square tube, ASTM A500, Grade B, for square pipe at lintels and gate posts, minimum galvanizing coating of 1.8 ounces per sq. ft. 2-1/2 inchs square.

C. Fabric: Type II ASTM A817, Class 2 ASTM A392, Class 2 (not less than 2 oz/ft sq.), galvanized before (G.B.W.) weaving, 2-inch mesh, 9 gauge, interwoven, top and bottom knuckled selvage. Single width fabric.

2.03 CONCRETE MIX

A. Concrete: Normal Portland cement; 3,000 psi at 28 days; 4 inch slump, conforming to ACI 318-11 Section 5.2, CBC Section 1905A and Division 32.
1. Design Mix: Conform to Section 1905A.1 CBC.
2. Reinforcement: per Division 32 as indicated on drawings.

2.04 COMPONENTS

A. Nominal pipe size (NPS) and weight in pounds per lineal foot, ASTM F1083; Schedule 40 Intermediate Strength Grade 50,000 psi, hot-dipped galvanized steel pipe, minimum 1.8 oz/sq.ft.

	NPS	Pounds/LF	Outside Diameter Min. (OD)
1.	1-1/4:	2.27	1.66"
2.	1-1/2:	2.72	1.90"
3.	2:	3.65 (3.87 for sq. pipe at exit gate frames)	2.375"
4.	2-1/2:	5.79 (5.79 for sq. pipe at exit gate posts)	2.875"
5.	3:	7.58	3.50"
6.	3-1/2:	9.11	4.0"
7.	6:	18.97	6.625"
8.	8:	24.58	8.625"

B. Line Posts for fencing

Fence height in feet	Outside diameter in inches

1.	Less than 6 feet	1.9
2.	6 to 7.9	2.375
3.	8 to 11.9	2.875
4.	12 to 16	4.0
5.	16 to 20	6.625

C. Terminal Posts - end, corner and slope.

	Fence height in feet	Outside diameter in inches
1.	Less than 6 feet	2.375
2.	6 to 8	2.875
3.	8 to 12	4.0
4.	12 to 16	6.625
5.	16 to 20	8.625

D. Swing gate posts, single leaf; opening widths in feet:

1.	Up to 6 wide	2" diameter
2.	6-13 wide	3-1/2" diameter
3.	13-18 wide:	6" diameter
4.	18 or more wide:	8" diameter

E. Sliding gate support posts shall be as follows:
1. Under 30 feet wide: 4" diameter weighing 9.1 lb/ft. Provide 1 latch post and 2 support posts at each leaf 12 feet on center, four support posts for double slide gates.

F. Top rail, mid rails, and braces: 1-5/8 inches diameter, plain end, sleeve coupled.

G. Top Rail Expansion Sleeve: 7 inches expansion sleeve with spring.

H. Swing Gate Frames: 1-1/2 inches diameter

I. Stiffeners for swing gates:1-1/4 inches diameter

J. Caps: Domed cast steel or malleable iron, galvanized and coated; sized to post dimension, set screw retained.

K. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings: Galvanized Steel.

L. Tension Wire: 7 gage thick coil spring steel, single strand, galvanized.

M. Truss Rod and Tightener: 3/8-inch diameter; furnish one at each end, pull, and gate post, and at both sides of corner posts.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with Section 304-3, SSPWC, ASTM F567 and manufacturer's instructions.

1. Line post-footing diameter: PER PLAN
   Embed posts into footing 6 inches less than the depth of the footing. Slope at top to shed water, 1/4" per foot.
2. Line post-footing minimum depth: PER PLAN
3. Gate post-footing diameter: PER PLAN
4. Gate post footing minimum depth: PER PLAN
5. For fencing higher than 12 feet: footing depth of 60" minimum and diameter of 36" minimum unless noted otherwise on drawings.
6. Reinforcing: per Division 32 and as indicated on drawings.
7. Posts set in hard rock concrete: drill holes 1 inch larger than post and set in non-shrink grout.

B. Provide fence height as indicated on Drawings.

C. Space line posts at intervals not exceeding 10 feet.

D. Set terminal, gate and line posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

E. Provide top rail through line post tops and splice with 7 inch long rail sleeves, outside sleeve type.

F. Brace each gate, corner, and end posts to adjacent line posts with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end and gate posts.

G. Center Rails: Install mid rails between posts with fittings and accessories for fabric height 12' and over, inclusive.

H. Install center and bottom brace rail on gate leaves, welded construction.

I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

J. Position bottom of fabric 2 inches above finished grade.

K. Fasten fabric to top rail, line posts, braces and bottom tension wire with tie wires maximum 16 inches on centers, one complete wrap.

L. Attach fabric to end, corner and gate posts with tension bars and tension bar clips.

M. Install bottom tension wire stretched taut [Install bottom rails] between terminal posts, (corner posts shall have brace rail).

N. Provide concrete center drop and drop rod retainers at center of double gate openings, except gates with panic hardware.

3.02 SWING GATES

A. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC 11B-404.

B. Gate Frames: 1-1/2 inch diameter steel pipe, welded corners, hot dip galvanized after fabrication.
   1. Exit Gate Frames: 2 inch square steel pipe, welded corners, hot dip galvanized after fabrication.

C. Sizes: As indicated on the Drawings, minimum widths of gates shall not be less than 36" (clearance of opening width shall not be less than 32 inches).

D. Hardware: Refer to Section 08 71 00, Door Hardware.
   1. Exit Device at Exit Gates only, outswing in accordance with 2019 CBC Sections 1008.1.9, 1008.1.10, and 1008.2, mounted 36" to 44" above finish floor. Exit Device (panic hardware) shall be mounted to provide 36" clear minimum below the device. Unlatching force not to exceed 5# applied in direction of travel.
   2. Gate Hardware Mounting: Mount at 34 to 40 inches above walking surface and according to 2019 CBC Sections 1008.1.9 and 1008.2 and 11B-404.2.7, 11B-404.2.9.
      a. Provide strike strap.
      b. Bolt keeper.
   3. Install 0.125 inch thick aluminum protective plate 24 in. high by width of gate behind panic device centered at 40 in. above finish surface. Secure to gate frame with #8 stainless steel screws at 6 in on center.
   4. Install 0.125 inch thick aluminum kickplate 10 inches high on push side (For larger gates install at both sides), CBC 11B-404.2.10, parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. Secure with #8 stainless steel screws 4 places each kickplate minimum. Clear space below gate shall be 3 inches maximum from walking surface on both sides of the gate.

E. All gates intended for pedestrian use, including ticket gates, shall comply with all applicable requirements of doors, CBC Section 1010.2. All gates in the Path of Travel and as indicated on the drawings shall require Exit Devices (panic hardware) as specified above, CBC Sections 11B-404.2.7, ADAAG 4.13.3, and 11B-404.2.9. Signage is not permitted in lieu of accessible or panic hardware.

3.03 SLIDING GATES

A. Reference ASTM F1184 Standard Specification for Industrial and Commercial Horizontal Slide Gates.

B. Gate Frames: Sizes of gate frame members and intermediate bracing as detailed on approved shop drawings.

C. Hardware: heavy duty metal stops, clips brackets and all required components. Gate hardware shall be mounted at 40" above finish floor.

D. Rolling Gates: As manufactured by Hoover Fence Co. or approved equal.
   1. Gates parallel with fence line using track and wheel system.
   2. Double Wheel Carrier: 6 inches for 1-5/8 inches frames.
   3. Rear Wheels: Provide for top and bottom rails.
   4. Pipe Track Brackets: Use to mount tracks to posts.

E. Provide positive locking device with padlock capability.

F. Gates shall operate freely and properly with minimum pull effort. Provide adjustments as required.

G. Space gate posts according to specified gate elevation. Posts shall be set in concrete footers having a minimum depth of 48" with a minimum diameter of 12" unless noted otherwise on drawings.

3.04 TESTING

A. At Architect's option, Contractor shall be required to cut any pipe column after installation to confirm requirements of this Specification. If conformance is confirmed, replacement members shall be installed at Owner's cost. Components not meeting required standards shall be replaced.

END OF SECTION

SECTION 32 31 13.10

FENCES AND GATES - PVC COATED

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. PVC coated fence framework, fabric and accessories.

B. Excavation for post bases.

C. Concrete anchorage for posts.

D. Tennis fabric.

E. Lock Box.

F. Related Sections:
   1. Division 32, for concrete footings.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM - American Society for Testing and Materials
   1. ASTM A569 - Steel, Carbon, Hot-Rolled Sheet and Strip, commercial quality
   2. ASTM F567 - Practice for Installation of Chain-Link Fence
   3. ASTM F668 - Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric
   4. ASTM F934 - Standard Colors for Polymer-Coated Chain Link Fence Materials.

C. SSPWC - Standard Specifications for Public Works Construction, 2000 Edition.

D. CLFMI - Chain Link Fence Manufacturer's Institute.

E. CBC - 2019 California Building Code
   1. CBC-10 - Chapter 10, Means of Egress
   2. CBC-19 - Chapter 19A, Concrete

F. National Ornamental and Miscellaneous Metals Association (NOMMA)
   1. NOMMA Guidelines - Guideline 1 Joint Finishes

1.03 SUBMITTALS

A. Shop drawings including plan layout, grid, spacing of components, accessories, fittings, hardware, footings, anchorages and schedule of components.

B. Product data on each specified product and accessory.

C. Manufacturer's installation instructions.

D. Certifications: Manufacturer's material certifications in compliance with current ASTM specifications.

E. Three samples illustrating each fence fabric finish.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in commercial quality chain link fencing with five years of experience.

B. Installer: Demonstrated successful experience installing chain link fencing on similar projects in accordance with ASTM F567 and have at least 5 years' experience.

1.05 WARRANTY

A. Provide a two year warranty to insure materials against rusting or breakdown of finish. Provide adjustments as needed to assure continued smooth operation of gates.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404.

B. The levers of lever actuated latches or locks for accessible gates shall be curved with a return to within 1/2" of the gate surfaces to prevent catching on the clothing or persons.

C. Acceptable Manufacturers:
1. Any Manufacturer who is a current member of the Chain Link Fence Manufacturer's Institute.
2. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.02 MATERIALS

A. Framework: ASTM F1083, galvanized and PVC coated steel pipe. Class 1, sized in accordance with Tables 206-6.2, Standard Specifications for Public Works Construction. One piece without joints in accordance with CLFMI. PVC clad coating min. 15 mils per SSPWC 210-5.2.

B. Fabric: ASTM F668 PVC coated galvanized before weaving, minimum 9 gage, interwoven, 2 inch mesh, top selvage, knuckle end closed, bottom selvage knuckle end closed. Class permitted:
1. Class 2b: PVC fused and adhered (fusion bonded) to zinc coated wire, 7 mils thick.

2.03 CONCRETE MIX

A. Concrete: Normal portland cement; 3000 ~~2,500~~ psi at 28 days; 4 inch slump, conforming to Section 1905A.3, California Building Code.

2.04 COMPONENTS

A. Nominal piping diameter without galvanizing or coating, in inches and weight in pounds per lineal foot:

		Class 1
1.	1-1/4:	2.27
2.	1-1/2:	2.72
3.	2:	3.65
4.	2-1/2:	5.79
5.	3:	7.58
6.	3-1/2:	9.11
7.	6:	18.97
8.	8:	24.58

B. Posts for fencing less than 6 feet in height:
1. Line: 1.9 inches dia.
2. End, Corner and Slope: 2.375 inches dia.

C. Top rail, mid rails and braces: 1-5/8 inches diameter, plain end, sleeve coupled.

D. Caps: Domed cast steel or malleable iron, coated sized to post dimension, set screw retained.

E. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings: Coated Steel.

F. Tension Wire: 7 gage thick coil spring steel, single strand, galvanized or coated.

G. Truss Rod and tightener: 3/8 inch diameter at end and gate posts, both sides of corner posts.

2.05 FINISHES

A. Chromate Conversion and Clear Acrylic Urethane Coating: on Class 1A pipe, in accordance with Section 210-4, SSPWC.

B. Interior Surface Coating for Class 1 Pipe: In accordance with Section 210.3.2 SSPWC.

C. PVC Coating on framework and fabric: In accordance with ASTM F1043 and SSPWC 210-5.2. Color: Black.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with Section 304-3, Standard Specifications for Public Works Construction, ASTM F567 and manufacturer's instructions.

1. Post Footings: PER PLAN
   Embed posts into footing 6 inches less than the depth of the footing. Slope at top to shed water, 1/4" per foot.
2. Posts Minimum :PER PLAN
3. Reinforcing: as indicated on drawings.
4. Posts set in hard rock concrete: concrete drill holes 1 inch larger than post and set in non-shrink grout.

B. Provide fence of height indicated on drawings.

C. Space line posts at intervals not exceeding 10 feet.

D. Set terminal and line posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

E. Provide top rail through line post tops and splice with 7-inch-long rail sleeves, outside sleeve type.

F. Brace each corner post back to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end posts.

G. Install center and bottom brace rail on corner leaves.

H. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

I. Position bottom of fabric 2 inches above finished grade.

J. Fasten fabric to top rail, line posts, braces and bottom tension wire with wire ties maximum 16 inches on centers.

K. Attach fabric to end, corner posts with tension bars and tension bar clips.

L. Install bottom tension wire stretched taut between terminal posts, (corner posts shall have brace rail).

3.02 TESTING

A. At Architect's option, Contractor shall be required to cut any pipe column after installation to confirm requirements of this specification. If conformance is confirmed, replacement members shall be installed at Owner's cost. Components not meeting required standards shall be replaced.

END OF SECTION

SECTION 32 31 19

FENCES AND GATES - ORNAMENTAL METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Ornamental Metal Fencing
2. Manually operated, swing gates
3. Rough and finish hardware, fasteners, and related accessories

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. American Society for Testing and Materials (ASTM)
1. ASTM A36 - Carbon Structural Steel
2. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
3. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
4. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
5. ASTM A641 - Standard Specifications for Zinc-Coated (Galvanized) Carbon Steel Wire
6. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
7. ASTM A568/A568M - General Requirements for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
8. ASTM B117 - Test Method of Salt Spray (Fog) Testing
9. ASTM B221-Standard Specification for Aluminum and Aluminum – Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
10. ASTM C1107 - Packaged Dry, Hydraulic - Cement Grout (Non-Shrink)
11. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
12. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
13. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test

C. American Welding Society (AWS)
1. AWS D1.1 - Structural Welding Code, Steel
2. AWS A5.1 - Carbon Steel Electrodes for Shielded Metal Arc Welding
3. AWS 5.5 - Low Alloy Steel Covered Arc Welding Electrodes.

D. American Institute of Steel Construction (AISC)
1. AISC Specifications - Manual of Steel Construction

E. 2019 California Building Code (CBC)

1. CBC 10 - Chapter 10, Egress Requirements
2. CBC 11 - Chapter 11, Accessibility
3. CBC 19A - Chapter 19A, Concrete

1.03 SUBMITTALS

A. Product Data for each fencing system component and accessory item.

B. Shop Drawings, showing materials, construction and fabrication details, layout and erection diagrams as required, finish of materials and methods of anchorage to adjacent construction. Indicate welding by AWS code symbols.

C. Samples
1. Color Selection Samples for each specified pre-finished item
2. Record Samples of selected finishes
3. Material Samples. If requested, submit samples of materials. Samples of finials, caps, and accessories shall be whole pieces.

1.04 DELIVERY, STORAGE AND HANDLING

A. Stack, store, and handle fencing sections and components to prevent damage during transit and storage at the site. Follow manufacturer's instructions.

1.05 PROJECT CONDITIONS

A. Verify Existing Conditions. Verify conditions, affecting work of this Section, by taking accurate measurements at site of dimensions, elevations, and grades. Fabricate work to fit measured dimensions.

1.06 SPECIAL WARRANTY

A. Manufacturer and installer shall jointly warrant that the installed fencing and gates are and will remain free from defects in material and workmanship including cracking, peeling, blistering and corroding of finish for a period of at least 5 years from the date of Substantial Completion. Upon written notice from Owner, they shall promptly, without cost, and with the least practicable inconvenience to Owner correct such defects.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404.

B. The levers of lever actuated latches or locks for accessible gates shall be curved with a return to within 1/2" of the gate surfaces to prevent catching on the clothing or persons.

C. Swing doors and gate surfaces within 10" of the finish floor or ground shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plate shall be capped. CBC Section 11B-404.2.10.

2.02 MANUFACTURERS

A. Acceptable Manufacturers
   1. Ameristar Fencing Products, Tulsa, OK.
   2. Or equal, approved in accordance with Division 01, General Requirements, for substitutions.

2.03 MATERIALS

A. Steel Material: ASTM A924, A123 and ASTM A653, hot-dipped galvanized, G-90 for sheet steel, cold-rolled, butt welded, square or rectangular, minimum 45,000 psi.
   1. See plans for details.

B. Screws: stainless steel, self-drilling hex-head screws. Type 304 or 316 stainless-steel fasteners.

C. Threaded Bolts and Nuts: Standard, commercial quality, hot-dip, galvanized, steel conforming to ASTM A307.

D. Accessories: Internal retaining rod, panel brackets, post and picket caps , rubber grommets picket to rail.

E. Touch Up Material for Galvanized Coatings: Anodic zinc-rich coating or hot applied repair compound.

F. Concrete for Footings: Specified in Section 32 13 13, Sitework Concrete.

G. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 5,000 pounds per square inch in 24 hours and 8,000 pounds per square inch in 7 days; of consistency suitable for application and 30 minute working time.

2.04 COMPONENTS

A. Fencing: Per plan.

B. EXIT Gates: galvanized square tube, ASTM A500, Grade B, at lintels and gate posts, minimum galvanizing coating of 1.8 ounces per sq. ft. 2-1/2 inches square. Final finish to match fencing finish.

2.05 ACCESSORIES

A. Swing Gates: 1.75" x 14 gauge forerunner Double channel rail, 2" square x 11 gauge gate ends, and 1" square x 14 gauge pickets. Gates exceeding 6’ in width shall have 1.75" sq x 14 gauge intermediate upright. All rail and upright intersections hall be joined by welding. All pickets and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection. Provide cable kits for additional truss for gates leaves over 6 feet.

B. Swing Gate Hardware. Provide hardware and accessories for each hinged, swing gate, galvanized and shop finished to match adjacent gate and fence components.
   1. Hinges: weldable steel barrel type hinge, ball bearing, non-removable steel pin. Provide two hinges for each leaf up to 6 foot nominal height, and one additional hinge for each additional 24 inches in height, or fraction thereof. 5" barrel hinge, Model: 44-2003 King Architectural Metals, Los Angeles, CA, or equal. Two hinges per leaf for gates up to 5'-11" wide, three hinges per leaf for 6' to 10' wide gates.
   2. Locks: Self-latching bolt and deadbolt, 3/4 inch diameter, adjustable, lockable, with lever handle, by Ameristar Lock or equal, keyed lock. Hardware shall not require pinching, grasping or twisting motion. The lever of lever-activated latches or locks for an accessible gate shall be curved with a return to within 1/2" of the (face of) gate to prevent catching on the clothing or persons.
   3. Double Gates: Provide center lockable cane bolt assembly mounted to gate vertical frame designed to engage strike with anchors, set in concrete. At double gates provide locking slide bolt. Cane Bolts not permitted at Path-of-Travel gates.
   4. Gate Hardware: Shall be mounted at 40" above finish floor.

5. All gates intended for pedestrian use, including ticket gates shall comply with all applicable requirements of doors. All gates in the Path of Travel and as indicated on the drawings shall require Exit Devices (panic hardware) as specified above, CBC Sections 11B-309.4 and 11B-404.2.9. Signage is not permitted in lieu of accessible or panic hardware.
6. Exit Device at Exit Gates only, outswing in accordance with CBC Sections 1008.1.9, 1008.1.10, and 1008.2, Mounted 36" to 44" above finish floor. Exit Device (panic hardware) shall be mounted to provide 36" clear minimum below the device. Unlatching force not exceed 15# applied in direction of travel.
    a. Panic Bar: Exit Device: Sargent 3828F Series exit device, with sprayed alum enamel finish, 649 strike, and Trim Pack 28-K-LL, with 34 Series rim type cylinder for key operation, outside lever at single gates, devices in exit pathways where shown on drawings, attach to gate post, include cylinder. Lever handle on exterior of gate. Lever to return to within ½" of gate surface.
7. Accessories: 4" x 3" x 1/4" x 8" high galv. steel angle welded to strike-side frame and 1" x 3" x 1/4" thick bolt keeper.
    a. Fabricate galv. Steel lock box 16 ga x 3" high x 8" wide x 1-3/4" thick to encase lockset, weld all joints and grind smooth, touch up with galvanizing compound.
8. Perforated Metal Panel: Manufactured by McNichols Co. Tampa, FL. Aluminum Plate: Perforated , 0.125 inch thick with 1/4 inch diameter holes 42 percent open area, 24 in. high by width of gate behind panic device centered at 40 in. above finish surface. Secure to gate frame with #8 stainless steel screws at 6 in on center.
9. Install 0.125 inch thick aluminum kick plate 10 inches high on push side (For larger gates install at both sides). Clear space below gate shall be 3 inches maximum from walking surface on both sides of the gate. Secure with #8 stainless steel screws 4 places each kick plate minimum.
10. Gate Closer for push out installation: ANSI A156.4, Grade 1. Install hydraulic gate closer, Model Dor-O-Matic SC71, Norton 7500/7700 Series, LCN 4041, Sargent 351, or equal. Arm: Rw/PA (regular arm with parallel arm bracket), adapter offset shoe, plate and spacer, TBSRT (thru bolt self reaming and tapping) screws, plate. ADA compliant. With metal cover, corrosion resistant. Attached to 2-1/2 inches square lintel. For top-of-post installation use Rixson 1351, "PFGCS-Positive Force Gate Closing System" by Pacific Lock & Security, Cypress, CA, "Swinger 300" model SW300 by Hoover Fence Co. or equal. Closing force to be limited to 5 lbs maximum.

2.06 FABRICATION

A. Provide new stock of standard sizes specified or detailed. Fabricate materials in shop to produce high-grade metal work. Form and fabricate to meet required conditions.

B. Pickets, rails and posts shall be pre-cut to specified lengths. Rails pre-punched to accept rails.

C. Include bolts, screws and other fastenings necessary to secure work.

D. Conform applicable work to latest edition of AISC Specifications and AWS D1.1.

E. Accurately make and tightly fit joints and intersections in true planes with adequate fastenings.

F. Coordinate Work with work of other sections. Provide punchings and drillings indicated or required for attachment of Work to other Sections.

G. Welding: weld joints, unless otherwise indicated or specified, using shielded electric arc method. Use coated welding rods, not fluxed or type recommended by manufacturer for use with parent metal.

H. Grinding: Grind welds to smooth flush joints.

I. EXIT Gates: Fabricate posts and lintels to height indicated on drawing but no less than 6’-8", and ready to receive closer and gate hardware.

2.07 FINISHES

A. Base Coat: epoxy electrostatic powder coat over prepared galvanized steel, minimum thickness 2 mils.

B. Finish Coat: TGIC Polyester electrostatic powder coat topcoat. Thickness 2 mils, minimum.

C. Color: black.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify existing conditions are ready the work of this Section. Do not begin erection of fencing until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Post spacing: Line posts shall be spaced in line maximum of 96 inches on center.

B. Post Footings: Per plan.

C. Post Tops: Line posts shall be fitted with pressed steel caps. Gate post top: Welded flush and ground smooth .

3.03 GATES

A. Gate posts shall be set in accordance with the spacings shown in the drawings.

B. Fabricate gates to size and configuration indicated on Drawings, complete with gate hardware.

C. Install locking fittings to accommodate owner's keying system.

D. Attachments to gate shall be permanently secured to assembly. No clamp-on or exposed bolted fittings shall be permitted.

E. All gates intended for pedestrian use, shall comply with all applicable requirements of doors. All gates in the Path of Travel and part of the accessible route and as indicated on the drawings shall require Exit Devices (panic hardware) and meet all the requirements of an accessibly door in compliance with CBC Section 11B-404 and as specified above. Signage is not permitted in lieu of accessible or panic hardware.

END OF SECTION

SECTION 32 84 00

IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

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

B. Section Includes:
1. Install a modified irrigation system including materials, equipment and procedures required for the Work.

C. Related Sections:
1. Section 32 93 00: Planting.

1.02 SYSTEM DESCRIPTION

A. Regulatory Requirements:
1. Comply with local, municipal and state laws, rules and regulations governing the work.

1.03 SUBMITTALS

A. Submit in accordance with Section 01330; Submittals.
1. Materials List: Include manufacturer's name and description of items to be furnished.

C. Closeout Submittals:
1. Submit a complete list of materials including manufacturer's name and product installation literatures.
2. Record drawings: Submit dimensioned plan drawings and details, prior to completion.

D. AS-BUILTS

1. As-Builts: Four (4) copies shall be submitted, completed, and approved prior to the final inspection.
2. The As-Builts shall be computer generated (Auto Cad 14 or latest version or any compatible C.A.D. program.
   a. Prints shall show the locations of the marked remote control valves, flow sensors, master valves, manual control valves, locations and size of all supply and lateral lines, sleeves, location and type of all sprinkler heads, quick coupling valves, isolation valves, backflow devices, point of connections, controllers and all other related equipment.
   b. Dimensions shall be legible from two permanent points of reference such as buildings and sidewalks.
   c. Drawings shall be a full size 24" x 36" minimum.

1.04 SUBSTITUTIONS

A. If the irrigation contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation specifications or job scope, the contractor may do so by providing the following information to the Project Manager for approval:
   1. The Contractor shall provide a statement indicating the reason for making a substitution, using a separate sheet of paper for each item to be substituted.
   2. The contractor shall provide descriptive catalog literature, performance charts, and flow charts for each item to be substituted illustrating that the alternate item meets or exceeds the specifications of the original item.
   3. The contractor shall provide the amount of cost saving if the substituted item is approved.

B. The contractor shall be responsible for the total performance of such substitution to equal or surpass the original in every respect.

C. If the substitution proves to be unsatisfactory in the opinion of the, the contractor shall remove such work and replace it with the originally specified item (including installation) at no cost to the District.

D. The Project Manager shall have the sole responsibility for accepting or rejecting any substituted item as an approved equal to equipment and material listed on the irrigation specifications and scope of work.

1.05 QUALITY ASSURANCE

A. Qualifications: Work shall be performed by skilled workers and by an installer licensed to perform irrigation sprinkler installation.

B. Regulating Requirements: 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 provision shall be carried out by the contractor. Nothing contained in these specifications, however, shall be construed to conflict with any of the above rules and requirements of the same. When these specifications and drawings call for or describe materials, work, 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.

1.06 WARRANTY

A. Provide a one-year warranty, for labor and materials necessary to maintain sprinkler irrigation system in full operating condition.

1.07 MAINTENANCE

A. Maintenance Manuals:
   1. Provide complete operating and maintenance instruction manuals for new equipment.

B. Extra Materials:
   1. Keys and Wrenches: Provide the following items:
      a. One coupler for each four quick coupler valves installed.

1.08 PRODUCT HANDLING

A. Exercise care in handling, loading, unloading and storing pipe and fittings. Store materials under cover. Transport in a manner to prevent undue stresses on piping and other materials.

1.09 IRRIGATION LEAD MAN

A. An irrigation lead man satisfactory to the Project Manager shall be present on the site at all times during the progress of work.
   a. The lead man must be able to speak English and communicate with the Project Manager, District Inspector, and school site staff.
   b. The lead man must be knowledgeable of the specifications and Scope of Work and have access to these documents on the project site.
   c. The lead man shall be authorized to represent the contractor.

1.10 PROJECT CONDITIONS

A. The contractor shall be acquainted with all site conditions and exercise extreme care in excavating and working near existing utilities. The contractor shall call Dig Alert two (2) days prior to any excavation (1-800-227-2600) and shall provide the verification number from Dig-Alert at the job start meeting. The contractor shall become familiar with all on-site underground utilities prior to any trenching.

B. Should the contractor damage any utilities or piping during excavation or at any time on the school site, the contractor shall promptly notify the Project Manager for instruction as to further action. Failure to do so shall make the contractor liable for any damage thereto arising from his operations subsequent to discovery of such utilities not shown on plans.

1.11 INSPECTIONS: SPECIFICATIONS & SAFETY

A. Daily inspections shall be performed without prior notice and the inspector will call upon the irrigation lead man to assist in verifying that installation meets the specifications.

   Daily safety inspections will be performed without prior notice by the inspector, project manager, or school site staff. The contractor shall adhere to all safety recommendations made at the job walk or respond to any safety-related issues concerning this project. At any time the contractor receives either a verbal or written request to rectify a safety concern, s/he shall stop work and immediately correct the safety issue. Any time a contractor receives a written notice for a safety violation, s/he shall consider this a legal step to remove the contractor from this project.

B. The contractor shall notify the inspector 24 hours in advance for the pressure side piping inspection.

C. The contractor shall submit a request for a final inspection 48 hours in advance. When the sprinkler system has been completed, the contractor, in the presence of the District Inspector and the Project Manager, shall perform a coverage test to determine if the coverage of water to turf and planting areas is complete and adequate.

D. The following items shall be considered part of the final inspection:
   1. All items and materials covered in the specifications.
      Guarantee form and product warranty information.
   2. Soil compacted in trenches and around sprinkler heads, level with existing elevations.
   3. Sprinkler control valves and boxes.
   4. Final site review and acceptance:
      a. The contractor shall operate each system in its entirety for the District Inspector. Any system deemed not acceptable by the District Inspector, or not in compliance with these specifications and scope of work, shall be reworked to complete satisfaction of the District Inspector.

1.12 GUARANTEE

1. The guarantee for the irrigation system shall be made in accordance with the following form. The general conditions and supplementary conditions of these specifications shall be filed with the Project Manager upon completion of the project. The standard one (1) year guarantee shall include:
   a. Filling and repairing depressions due to settlement of irrigation trenches for one (1) year following acceptance of project.
   b. All items stated within the plans, specifications, construction notes, etc. specific to this project.

2. A copy of the signed guarantee form shall be present at the final inspection.

The guarantee form shall be on the contractor's letterhead and contain the following information:

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee for one year from the date of acceptance by that the sprinkler irrigation system we have furnished and installed is free from defects in material and work, and the work has been completed in accordance with the specifications and the scope of work.

In the event that work performed by the contractor is faulty or defective materials are provided and/or erected/applied by him/her, the District will notify the contractor to that effect in writing. In such notice the District will order the contractor to remove (at his/her own expense) the faulty work and/or defective materials and to replace it with work and/or material that conforms to the requirements of the Contract. The District will also state in the said notice the time within which the contractor must begin the said removal and replacement and must complete the same. Upon receipt of this notice, the contractor must proceed forthwith to remove said faulty work and/or defective material from the site. The contractor shall then replace the same with new work and/or material that will conform to the provisions of the contract, using methods and materials approved by the District. The contractor shall

also repair and/or replace (at his/her own expense) all work and/or material that is damaged, injured, or destroyed by the removal of said faulty work and/or defective material or by replacement of same with acceptable work and material as directed by the District Representative. If the contractor does not fix the problem within the time frame stated in the written notice, will proceed in having the repairs made and the contractor shall be responsible for all charges incurred.

Signature of Responsible Party

PROJECT: _____
(School or site)

CONTRACTOR: _____ LIC. NO.: _____

ADDRESS: _____

PHONE: _____ FAX: _____

DATE OF ACCEPTENCE: _____

BY:(Signature of project manager) _____

Typed or printed name of Project Manager _____

NAME OF DEPARTMENT PROJECT MANAGER REPRESENTS:

_____

BRANCH OR COMPANY NAME:

_____

PART 2 – PRODUCTS

2.01 MATERIALS

A. GENERAL: Use only new materials, of brands and types noted on drawings, specified herein, or approved equals.

B. The contractor is to review all materials with supplier and allow sufficient time to order any product requiring lead-time.

C. Pipe and Fittings:
   1. Plastic Pipe shall be Schedule 40 and Class 200: Extruded from 100 percent Virgin Polyvinyl Chloride (PVC) Compound, meeting requirements of Class 12454-B of "Standard Specifications for Rigid Polyvinyl Chloride Compounds and Chlorinated Polyvinyl Chloride Compounds" ASTM D 1784.
      a. Plastic fittings shall be Schedule 40 molded from PVC Type I Compound, conforming to the requirements of Class 12454-B of ASTM D 1784.
      b. Nipples: Schedule 80.
      c. Plastic pipe shall be continuously and permanently marked with the

following information: Manufacturer's name, nominal pipe size, Schedule or Class, SDR (Standard Dimension Ratio, or pressure rating in PSI) National Sanitation Foundation (NSF).

d. PVC primer and solvent for chemical weld of pipe and fittings shall be as recommended by pipe manufacturer (IPS Weld-On P-70, IPS Weld-On 2711 [gray] cement; Spears Blue 75 [SB75]). Containers for solvent and primer shall be clearly marked with manufacturer's data. Solvent and primer shall not be more than one year old. Blue or red-hot glue shall not be used on the project.

2. Connection between steel pipe and copper pipe or tube shall use a brass nipple.
3. Connection between any female threaded fitting and plastic pipe shall be made with a Schedule 80 nipple.
4. Steel pipe or fittings shall not be used underground.
5. Brass Pipe: Seamless, 85 percent red brass, iron pipe sized, threaded.
6. Brass Fittings: Bronze and brass 250 PSI, screwed, A.S.A. B16.17 and FSWW-P-460.

D. Shut-off Valves:
1. Gate valves on pipe 3-inch and larger shall be A.W.W.A. Specification, Class "D" dimensions caulk bells, or standard flanged, or a combination of outlets as required, iron body, brass trimmed, non-rising stem with operating nut. Gate valves 3-inch or smaller shall be bronze, non-rising stem, screwed.
2. Quick coupler valves shall be all brass, 1-inch, with lock top and rubber cap.
   a. Quills shall be the same manufacturer as quick coupler valve, cast bronze, machine shank, stainless steel or bronze lugs.
3. Couplers shall be same manufacturer as quick coupler valve, cast bronze, machined shank, stainless steel or bronze lugs.
4. Electric remote control valves shall be 24-volts capable of operating on #14 gauge UF wire; either bronze or brass, globe or angle pattern, and diaphragm actuated.

E. Yard Boxes And Remote Control Boxes:
1. Yard boxes installed in pavement shall be Brooks 4-TT 10-1/4” traffic box with cast iron traffic cover marked “Irrigation”, or larger, as may be required to obtain specified clearance.
2. Pull boxes to be Brooks 3-1/2 (T) PB 10” x 17” pull box w/full bolt-down traffic cover marked “Irrigation”.
3. Remote control valve boxes for turf areas or shrub areas shall be Carson, or approved equal, large rectangular. Use Cover with Captive Pentahead “L” Bolt.

F. Irrigation Wire: Paige - P7079D, or approved equal
H. Gate Valve: NIBCO Model T113, or approved equal
I. Remote Control Valve: Superior Model 950-DW, or approved equal
J. Ball Valves: NIBCO Model T-113, or approved equal
L. Tree Irrigators: Rainbird, Hunter, or approved equal.
M. Valve Boxes: NDS Model 312 BCB (round) or 314 BCB (rectangular), or approved equal. All lids to be traffic rated.
N. Valve ID Tags: Christy, or approved equal
O. Irrigation Piping:
1. All piping to be PVC Schedule 40
2. PVC fittings: Spears or approved equal
3. PVC Mainline Solvent: Weld-on - 2711 - Heavy

4. PVC Lateral Line Solvent: Weld-on - 2721 - Medium
5. PVC Primer - Weld-on - P-70

P. Performance Requirements
1. Minimum Working Pressures:
a. Irrigation Main Piping: 200 psi.
b. Circuit Piping: 150 psi.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Piping and devices shall be supported to maintain uniform alignment and prevent sagging by installing hangers and anchors of sufficient strength to support the weight of the pipe and its contents.

B. Isolate piping from incompatible materials.

3.02 LAYING PIPE

A. Trenches shall be deep enough to provide earth coverage of 12-inch for non-pressure lines and 18-inch for pressure lines, from finished grades to top of pipe. The bottom of trenches shall be free of rocks, clods, and other sharp-edged objects. Piping in ground shall be laid on a firm bed for its entire length.

B. Plastic pipe and fittings 2” and below shall be Schedule 40 PVC solvent welded, using solvents and methods recommended by the pipe manufacturer. Plastic pipe 3” and larger shall be gasket Class 200 PVC. Remove all dust, dirt and moisture from pipes and fittings before applying primer and solvent; wipe excess solvent from joints with a clean rag. Primer shall be used on all PVC glued joints, pressure and non-pressure piping.

C. Welded joints shall cure at least 15 minutes before moving or handling and at least 24 hours before water will be permitted in pipe, or as recommended by manufacturer.

D. Pressure piping installed under a driveway or sidewalk shall be sleeved; sleeves shall be two pipe sizes larger.

E. Piping through concrete and asphalt pavement shall be L type copper with ¼-inch of foam wrap around the pipe to allow for expansion.

F. Holes cored through walls shall be two pipe sizes larger to allow for foam wrap around pipe.

G. PVC pipes shall not be installed above ground unless approved by the District Inspector.

H. Lettering shall be facing up on all under ground PVC piping.

3.03 IRRIGATION HEAD INSTALLATION

A. After installation, examine system operation for complete coverage. Make adjustments, as may be required to provide complete coverage.

B. Branch lines, swing joints or sprinkler risers shall not be sized smaller than the sprinkler heads they serve.

3.04 YARD BOX INSTALLATION

A. Enclose underground gate valves in yard boxes of sufficient size to provide no less than 1 1/2-inch of clearance on all sides of equipment installed therein.

B. Sides and ends of yard boxes shall be extended down to the centerline of the main line when the main is more than ¼-inch below the bottom of the box. The box shall enclose all shut-off valves below ground.

C. Yard boxes in paved areas shall be set in a concrete bed 4-inches thick with a clearance of at least 1-inch below pipe or below the walls of the box.

D. Yard and remote boxes shall be installed level to grade.

3.05 REMOTE CONTROL VALVE BOX INSTALLATION

A. The remote control value box shall extend to the body of the valve, and box tops shall be 2-inches above finished grade in mulched areas. In turf areas, the top of the box shall be flush with finished turf grade. In paved areas, box tops shall be flush with finished grade. Plastic yard box covers shall be bolted down.

B. Pea gravel shall be filled up to the bottom of the manual and remote valve and there shall be at least 4-inches of gravel inside of the valve box.

C. Emboss or “Brand” remote box lids with 3-inch size numbers, showing number that corresponds with controller station and a 3-inch size letter to show which controller it serves. There shall be one remote valve for each remote box.

3.06 QUICK COUPLER VALVES AND ASSEMBLIES

A. Install quick couplers 1-inch above finished grade.

3.07 VALVES

A. Pressure piping system shall be supplied with valves at all points where required.

B. Valves shall be installed with the best of workmanship, neat appearance and groupings; so all parts are easily accessible. Valves near walk curbs and appurtenances shall be set back 12-inches.

C. Valves shall be full size of line in which they are installed unless otherwise indicated.

D. Remote Control Valves & Manual Sprinkler Valves:
   1. Remote control valves shall be low wattage (24-volts) and shall be capable of operating properly on no larger than #14 gauge UF wire.
   2. Remote control valves shall be adjustable to control flow of water through valve adjustments and shall be accessible through valve boxes installed above each valve.

3. Remote control valves shall be installed and adjusted so that sprinkler heads operate at pressure recommended by head manufacturer. Remote control valves shall be adjusted so that a uniform distribution of water is applied by sprinkler heads to planting areas from each individual valve system.
4. Remote control valves on any line shall be installed 3-inches minimum and 8-inches maximum below finish grade to top of flow control stem.
5. Remote control valves shall be installed with schedule 80 nipples on the inlet and outlet side of valve.
6. Manual and remote control valves for lawn and shrub areas shall be installed within the perimeter of the area it serves.
7. Manual and remote control valves for all athletic fields shall be installed in the following specified location:
   a. Control valves shall be grouped together, installed on the perimeter of the athletic field and installed in yard boxes.
   b. Provide Manual operating key to District.

3.09 CONTROL WIRE

A. Re-use of existing. Provide splices as necessary and install in an 8” round plastic valve box. Bundle 18” of control wire inside box. Locate splice box in planter area.

3.10 VERIFICATION AND TESTING

A. The contractor shall notify District Inspector 24 hours in advance for the pressure side piping inspection.
   1. Pressure Side Piping: After all pressure-side equipment has been installed (gate valves, remote control valves, quick-couplers, etc), welded joints have cured for at least 24 hours, lines are flushed, and outlets are capped, the system shall be tested under local water pressure plus 20% for a minimum of 4 hours. Joints shall remain exposed for inspection during the pressure test. The contractor may center load pipe with back fill to prevent arching or slipping under pressure.
   2. Repair leaks and repeat pressure test, until the entire system is watertight.

B. Perform a coverage test to determine if the coverage of water to turf and planting areas is complete and adequate.
   1. Final site review and acceptance:
      a. The contractor shall operate each system in its entirety. Features of system deemed unacceptable shall be reworked, and the coverage test repeated.

3.11 CLEAN-UP

A. Clean up shall be performed as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed and washed down, and any damage sustained to the work of others shall be repaired and work returned to its original condition.

END OF SECTION

SECTION 32 93 00

PLANTING

PART 1 - GENERAL

1.01 SUMMARY

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

B. Section Includes:
1. Labor, materials and equipment required to complete landscape planting, as indicated.

C. Related Sections:
1. Section 32 84 00: Irrigation System.

1.02 SUBMITTALS

A. Material Samples:
1. Fertilization: Contractor shall furnish the Project Manager with delivery receipts for soil amendment materials to substantiate applications.
2. Pesticides: Submit manufacturer's literature and application methods for each pesticide proposed for use.

B. Certificates:
1. Submit a certificate with each delivery of bulk material, including import soil, stating source, quantity, and type of material, and that material conforms to Specification requirements.

1.03 QUALITY ASSURANCE

A. Plant Materials:
1. Plant materials shall be furnished in the quantities or spacing as shown or noted for each location, and shall be of the species, kinds, sizes and types, per symbol or as described on the Drawings.
2. All plant material will be inspected at the project site and inspected for conformance to these specifications.

B. Verification of Dimensions and Quantities: Before proceeding with work, Contractor shall carefully check and verify dimensions and quantities and shall immediately inform the Landscape Architect and the Project Manager of any discrepancies between Drawings and Specification and actual conditions.

C. Protection: Carefully and continuously protect areas included in work, such as lawns, plant materials, fences and supports, until final acceptance of the work by the City Inspector.

D. Pest Management Method and Products:
   1. Only pest management methods and products demonstrated to be safest and lowest risk to children will be used, those products that will not cause or those that will have the least health effects as cancer, neurological disruption, birth defects, genetic alteration, reproductive harm, immune system dysfunction, endocrine disruption and acute poisoning. Pest management methods and products used in the execution of this contract shall be in strict conformance with the City.
   2. Only pest management products that can be applied in a manner and at a time where no person can inhale or come into direct contact with them, or be exposed to volatile agents shall be used.

E. Quality Assurance
   1. Installer's Personnel Certifications: Certified Landscape Technician, CLT-Exterior.
   2. Soil analysis of each un-amended soil type.

F. Maintenance Service
   1. Trees and Shrubs: 3-months.
   2. Other Plants: 3-months

1.04 DELIVERY, STORAGE AND HANDLING

A. Plants shall be protected in transit and after delivery to project site. Plants in broken containers will not be accepted and plants with broken branches or injured trunks will be rejected.

B. Plant materials damaged in planting operations shall be replaced.

1.05 WARRANTY

A. Shrubs and groundcover shall be guaranteed for growth and health for a period of 90 days after completion of maintenance period. Trees shall be guaranteed by Contractor to live and grow in upright position for a period of one year after completion of the maintenance period.

B. Within 15 days after notification by the City Inspector, remove and replace plant materials that fail. Replacement materials shall be guaranteed as specified for original plant materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Soil Conditioners:
   1. Gro-Power Plus (bacteria included) with 1.25 percent soil penetrant and consisting of the following percents by weight: 5-nitrogen, 3-phosphoric acid, 1-

potash, 50-humus, 15-humic acid.

2. Nitrolized Redwood Sawdust: Containing minimum 0.5 percent nitrogen based on dry weight.
3. Shavings shall be mill-run shavings, not sawdust, nitrolized with a minimum of 1/2 percent nitrogen.

B. Pest Management Methods and Products
   1. Pesticides (insecticides, herbicides, fungicides, rodenticides, avicides and growth regulators) shall not contain any ingredients (both active and inert) that are:
      a. Banned, suspended, cancelled, discontinued or withdrawn by United States Environmental Protection Agency or Department of Pesticide Regulation of California Environmental Protection Agency.
      b. Not registered for the intended use with above agencies.
      c. Known or suspected to be a carcinogen according to International Agency for Research on Cancer (IARC), United States Department of Health and Human Services - National Toxicology Program (USDHHD-NTP), United States Department of Labor-Occupational Health and Safety Administration (USDOL-OSHA), California Safe Drinking Water and Toxic Enforcement Act of 1986 (Prop 65).
      d. Known to be mutagenic, teratogenic, oncogenic, neurotoxic, or cause reproductive hazards in humans.
      e. Listed as Class I Pesticides (extremely toxic) or labeled as "Danger".
      f. Classified as Highly Toxic by USDOL-OSHA if mode of application is spraying or broadcast-spreading.

C. Plant Materials: Plant materials indicated on Drawings and specified shall conform to the following:
   1. Nomenclature: Plant names on Drawings conform to "Standard Plant Names" established by the American Joint Committee on Horticultural Nomenclature; names not covered therein follow established nursery lexicon.
   2. Condition: Plants shall be symmetrical, typical for variety and species, sound, healthy, vigorous, free from plant disease, insect pests or their eggs. Plants shall have healthy, normal root systems, well filling their containers, but not root bound. Plants shall not be pruned prior to delivery except as authorized by the Landscape Architect.
   3. Dimensions: Height and spread of all plant material shall be as indicated and shall be measured with branches in their normal position. Caliper of trees shall be measured 4-feet above surface of ground. Where caliper or other dimensions of any plant materials are omitted, it shall be understood that these plant materials shall be normal stock for type listed.
   4. Groundcover plants shall be well rooted in flats or containers.
   5. Plants, General: Nursery-grown and complying with ANSI Z60.1.

PART 3 - EXECUTION

3.00 Planting required 90-days, minimum prior to occupancy.

3.01 EXAMINATIONS

A. Contractor shall schedule following inspections. Notify the City Inspector:
   1. When planting, sowing and other indicated.
   2. At the completion of the maintenance period as final inspection.

B. Plant materials shall be subject to examination and approval of the Landscape Architect before planting as part of the submittal process.

C. Contractor shall make a request to the Project Manager for a check inspection allowing 2 calendar days notice from completion of construction and planting operations. This examination with approval of the Landscape Architect, will establish start of Maintenance Period.

3.02 GRADING AND SOIL PREPARATION

A. Preliminary Grading:
   1. Preliminary grading shall be done in such a manner as to anticipate finish grading. Import soil where used, shall be dug into top 2-inches of the existing soil. Excess soil shall be removed or redistributed before application of soil amendments. Allowance shall be made so that when finish grading has begun there shall be no deficiency in specified depth of mulched planting beds.
   2. Moisture Content: Soil shall not be worked when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily. Water shall be applied, if necessary, to provide ideal moisture content for tilling and for planting.
   3. Weeding: After soil preparation and establishment of final grades prior to any planting, Contractor shall irrigate thoroughly for a period of time, 2 to 3 weeks or until weed seeds have germinated. When there is sufficient weed seed germination, Contractor shall apply a post-emergent weed killer. Contractor shall then wait an additional one week to allow weed killer to dissipate, then plant as indicated on Drawings and Specifications.

B. Finish Grading:
   1. When preliminary grading, including weeding and amendments, has been completed and soil has dried sufficiently to be readily worked, planting areas shall be graded to elevations indicated on Drawings. Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given. Minor adjustments of finish grades, if required, shall be made at the direction of the Landscape Architect. Finish grades shall be smooth, even, and at uniform planes with no abrupt change of surface. Soil areas adjacent to buildings shall slope away from buildings to allow a natural runoff of water, and surface drainage shall be as indicated on Drawings.
      Low spots and pockets shall be graded to drain properly. Finish grade of planting and lawn areas shall be 1 1/2-inches below grade adjacent to pavement.

C. Prepared Soil: Soil backfill in pits for trees, shrubs, vines, and for planter boxes shall

be a prepared soil per the agronomic soils report recommendations and per the following for bid purposes only - consisting of 2-parts nitrolized sawdust and 8-parts native on-site soil, measured by volume, to which shall be added 2-pounds of Gro-Power Plus per cubic yard of mix. Prepared soil shall be mixed in areas adjacent to planting work, and shall be accurately proportioned, using a suitable measuring container such as a wheelbarrow of measured capacity.

3.03 METHOD OF PLANTING

A. No planting shall be done until operations in conjunction with installation of sprinkler system have been completed, final grades have been approved, concrete and redwood headers have been installed, planting areas have been prepared as specified, and work tested and approved.

B. Relative position of trees and plants is subject to approval of the Landscape Architect, and they shall, if necessary, be repositioned as directed at no additional cost to the City.

C. Plants shall be set so that, when settled, they bear same relation to the required grade as they bore to natural grade – plus 2" - before being transplanted. Each plant shall be planted in center of pit and backfilled with prepared soil. No soil in muddy condition shall be used for backfilling. No filling will be permitted around trunks or stems. Broken or frayed roots shall be properly cut off.

D. Shrubs, unless otherwise indicated, shall be placed a minimum of 30-inches from buildings, walls, and fences.

E. Planting of Trees: Pits for trees shall be dug square with bottom level, length of sides equal to 2 times diameter of ball of tree and bottoms 8-inches below ball, except in paved areas, minimum length of sides shall be 4-feet and minimum depth 3-feet. Compacted soil at sides and bottoms shall be loosened by scarifying or other approved method. Pits shall be back-filled with compacted, prepared soil to bottom of the tree ball, tree set to required grade, balance of pit filled with prepared soil, and thoroughly settled by tamping and watering. Top of rootball/container shall be 4" above edge of water basin. Slope backfill towards mound, away from trunk. No water basin required for trees planted in gravel or on a slope.

F. Planting of Shrubs and Vines: Shrubs and vines shall be planted in pits at least 12-inches greater in diameter than ball of earth and at least 6-inches below bottom of ball. Compacted soil at bottom of pit shall be loosened and pit filled with prepared soil to bottom of ball. When plant has been properly set, pit shall be filled to the required grade with prepared soil, thoroughly settled by tamping and watering.

G. Mulching: Per plans.

I. Watering Basins: As detailed.

3.04 TREE SUPPORTS

A. Use 3 stakes in paved areas and 2 stakes in planting areas. Stakes shall be at least 10-feet long, placed and driven as indicated on drawings. Fasten stakes together and to trees per details.

B. Wire shall be double looped around each pipe and securely tied. A piece of rubber hose collars shall be used between each wire and the tree.

C. Placement: Stakes shall be located to prevent interference with operation of sprinkler system. If necessary, stakes shall be relocated as required or directed.

3.05 PESTICIDE APPLICATION

A. Application rates and methods shall conform to written recommendations of manufacturer and shall comply with regulations of the County Agricultural Commissioner and the Department of Agriculture, State of California.

B. Only well trained, competent operators shall be allowed to apply pesticides.

C. Certificated applicators shall be used wherever required by regulations of the County of San Bernardino, or the State of California or as determined by the City IPM Coordinator.

D. Pesticide application shall be performed in accordance with pertinent State and Federal laws and regulations. In addition, application shall be performed under following conditions, but not limited to:
   a. Posting warning sign according to City policy, verify.
   b. Using low pressure spraying when permitted.
   c. Strict adherence to manufacturer's recommended re-entry period after application.
   d. Pesticides shall be used in strict conformance to manufacturer's instructions on product labeling.
   e. Applicators shall use appropriate personal protective equipment recommended in accordance with product labeling. They include body coveralls, respirators, splash goggles and rubber gloves.

3.06 FINAL INSPECTION

A. Schedule the following inspections and notify the City Inspector:
   1. When planting, sowing and other indicated or specified work, except maintenance work, has been completed.
   2. Final inspection at the completion of the maintenance period.

B. Plant materials shall be subject to inspection and approval of the City before planting.

C. After completion of construction and planting operations, request for a check inspection. Allow at least 2 days notice prior to inspection. This inspection, with the

approval of the City, will establish the start of the landscape maintenance period.

D. Upon completion of the landscape maintenance period, request for a final inspection. Allow at least 2 days notice prior to inspection.

3.07 MAINTENANCE

A. Contractor shall continuously maintain areas included in Contract during progress of work, maintenance period, and until final acceptance of work.

B. Maintenance period shall be for a minimum of 90 days.

C. Maintenance shall be continued by Contractor if plant materials are not acceptable at end of Contract, or until acceptance by the City.

D. Maintenance shall include continuous operations of watering, weeding, trimming, edging, cultivating, fertilizing, spraying, insect and pest control, replacement or any other operations necessary to ensure good normal growth.

E. During installation period and during maintenance period, Contractor shall be responsible for maintaining adequate protection for planted areas.

F. At completion of maintenance period plant materials shall be alive, healthy, undamaged and free of infestations.

G. Replacements: Contractor shall replace plant materials and grass that is 50% dead or greater or damaged. Replacements shall meet requirements for original plantings.

H. Planted areas shall be kept free of debris, and shall be cultivated and weeded at not more than 10-day intervals. Grass, when 2-1/2-inches high, shall be mowed to a 1-inch height. Once established, grass shall be mowed at least once per week during maintenance period.

I. Water plantings adequately to ensure complete germination of seed and continued growth of plants.

J. In areas that do not have sprinkler coverage or which may require supplemental deep watering. Hose watering or temporary sprinklers on stands shall accomplish this.

K. Chemical herbicides may be used to control weeds when approved by the Campus IPM Coordinator.

L. Weed Control on Shrub Beds: Apply pre-emergent herbicide after planting. Herbicide shall be approved for use by the State and County and shall have minimal detrimental effect on groundcover plants. Rate and method of application shall conform to the written recommendations of manufacturer.

M. New Trees: Broadcast commercial fertilizer over planting pit at rate of 1/2 pound for

every inch of trunk caliper and water immediately. Repeat approximately 30 to 45 days after start of maintenance or after tree has produced definite signs of establishing itself after transplant and is producing new growth, whichever is first.

N. Shrub Areas: Fertilization: Shrub areas shall receive an application of commercial fertilizer at rate of 2-pounds per 1,000 square feet 30 days after start of maintenance. Irrigate after application.

R. Insect and Fungus Control: Contractor shall be alert for signs of insect presence or presence of damage from plant fungi. Upon locating such evidence, Contractor shall report matter to the City Pest Control Specialist and take remedial action as directed by the City IPM Coordinator.

3.08 CLEAN UP

A. Upon completion of planting operations and maintenance period, remove equipment and clean site of debris and superfluous materials.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Contractor shall furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all piping and including the demolition and removal of certain equipment, piping and appurtenances all as required and as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

B. Supply and installation of underground storm drain system within the owner's property as shown on the construction documents.

1.2 SUBMITTALS

A. Product Data: Manufacturer's catalog data for all required materials. Include technical data for pipe, drain inlets, catch basins, grates, information concerning gaskets, joints and couplings, sand bedding, tracer wire and detectable warning tape.

B. Contractor is responsible for providing shoring plans to the Inspector for approval prior to construction. Excavation shall have sheeting, shoring and bracing conforming to CAL/OSHA requirements. Lateral pressures for design of sheeting, shoring and bracing shall be based on type of soil exposed, groundwater conditions, surcharge loads adjacent to the excavation and type of shoring that will be used.

1.3 RELATED SECTIONS

A. Trenching Requirements: Conform to the requirements of Section 31 20 00 – Earthwork.

1.4 LICENSES, PERMITS & FEES

A. The Contractor shall have a Class "C-34", "C-36", "C-42" or Engineering "A" Contractors license valid in the State of California.

B. The Contractor shall obtain all necessary permits, licenses, or agreements required by any legally constituted agency, pay for all fees and give all necessary notices required for the construction of the work.

C. The Owner shall reimburse the contractor for all necessary permits or inspection fees by any legally constituted agency.

1.5 QUALITY ASSURANCE

A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("Green Book"), 2021 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".

1.6 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his equipment and materials against dirt, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with other utility work.

1.8 DISPOSAL OF REMOVED MATERIALS

A. All removed materials, except those indicated on the plans or described herein to remain the property of the Owner, shall become the property of the Contractor and shall be disposed in accordance with local, state, and federal laws. Should any of those materials be considered as hazardous the Contractor shall provide the Owners Inspector with paper custody trail documentation of the disposal.

1.9 SUBSTITUTIONS

A. The Contractor assumes full responsibility that alternate manufacturers, items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures which ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates were selected without proper regard to the requirements of the job, will not be approved. No more than one proposed alternate will be considered for each item.

B. This Contractor is responsible to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

C. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials and decisions of the Architect or that of his representative shall be final and conclusive.

1.10 RECORD DRAWINGS

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of redline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, pipe invert locations, drain basins, etc. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.11 INSPECTION OF WORK

A. Contractor shall not allow or cause any of his work to be covered up before it has been duly inspected, tested and approved by the Owner or any other authorized inspectors having legal jurisdiction over his work. Should he fail to observe the above, he shall uncover the work and, after it has been inspected, tested and approved, recover it at his own expense.

B. Inspection of the work shall not relieve the contractor of any obligations to complete the work as prescribed by the standard specifications. Any known defective work shall be corrected before testing or final inspection will be permitted. Unsuitable materials may be rejected even if these materials have been previously overlooked by the Inspector.

C. The Owner shall have the authority to suspend the work completely or in part for such time as it may deem necessary if the contractor fails to carry out instructions given by the Owner, or to perform any required provisions of the plans and specifications. The contractor shall immediately comply with a written order of the Owner to suspend the work completely or in part. The work shall be resumed when improper methods or defective work are corrected as ordered and approved in writing by the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Solid Wall Piping Materials

1. ADS N-12 WT (water-tight) IB Pipe, manufactured by Advanced Drainage Systems, Inc (ADS), or approved equal: High density polyethylene corrugated pipe (HDPE) with an integrally formed smooth interior and annular exterior corrugations. Pipe shall be joined with the N-12 WT IB joint meeting the requirements of AASHTO AASHTO M294 or ASTM F2306.

2. Poly Vinyl Chloride (PVC) Sewer Pipe, ASTM D-3034, SDR-35. The pipe will have a permanently installed reinforced rubber ring gasket in an integral bell joint. PVC

Sewer Fittings SDR-35 shall be manufactured in accordance with ASTM Standards D-3034 and F-1336 or F-679. The PVC material shall have a minimum cell classification of 12454-B, 12454-C or 12364-C as defined in ASTM D-1784.

3. Cast iron soil, hubless, with stainless steel-banded hubless couplings. No-hub cast iron soil pipe and fittings shall conform to ASTM A 888 and/or standard specifications 301 of the Cast Iron Soil Pipe Institute. No-hub joints shall conform to specification 310 of the Cast Iron Soil Pipe Institute and/or ASTM C 1277. Joints shall be installed according to manufacturer's recommendations. Manufactured by American Foundry, Tyler, or equal.

4. Poly Vinyl Chloride (PVC) Plastic Pipe, Schedule 40, meeting ASTM D 1785 standards. Fittings shall conform to ASTM D 2467 "Socket-Type PVC Plastic Type Fittings, Schedule 40.

B. Pre-Cast Concrete Catch Basins:
   1. Christy Concrete Products, Inc
   2. Brooks Products, Inc
   3. Eisel Enterprises Inc
   4. J&R Concrete Products
   5. Approved Equal

C. Grates & Covers:
   1. All grates and covers must be vandal proof / bolt down type.
   2. A.D.A. - Where noted on the plans install A.D.A. grates on catch basins. A maximum spacing between grating bars in accessible path of travel is 1/2 inch in the direction of travel, or 1/2 inch in either direction when the path of travel is not limited to one direction.
   3. Heel Proof - Where noted on the plans install heel proof grates on catch basins requiring a maximum ¼ inch opening.

D. Steel Reinforcing Bars: ASTM A 615 deformed grade 40 billet steel, plain finish, unless otherwise specified on Construction Document.

E. Concrete, Mortar and Related Materials: Conform to Section 32 13 13: Concrete Paving.

F. Manhole Brick Mortar, Grout, and Plaster: Conform to Standard Specifications for Public Works Construction, Section 202 - Masonry Materials.

G. Paint and Protective Coatings

   1. All storm drain hardware, including frames and covers, grates, protection bars, steps, etc., shall be protected from corrosion. Storm drain hardware made of cast iron shall be protected by painting with, or dipping in, a commercial grade asphalt paint. Storm drain hardware made of steel shall be galvanized.

   2. Hot-dip galvanize steel parts after fabrication and before installation, in accordance with Section 210 - Paint and Protective Coating of the Standard Specifications for Public Works Construction.

PART 3 - EXECUTION

3.1 PIPELINE INSTALLATION

A. Existing utilities: Locate existing underground utilities in all areas of work prior to excavation or commencement of work. If utilities are to remain in place provide adequate means of protection during trenching operations.

B. Install pipeline in a practical alignment and uniform slope to the point of connection as indicated on Construction Document. Prior to trench excavation, verify size, material, depth, and location of the point of connection. Notify Civil Engineer if point of connection elevation is different then that shown on construction drawing as it may affect the design of the system.

C. Excavating, trenching, and backfilling are specified in Section 31 20 00 – Earthwork.

D. No pipe shall be laid until the Geotechnical Project Manager inspects and approves the conditions of the bottom of the trench.

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

F. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

G. Use 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.

H. Make connections to existing piping and underground structures so finished work complies as nearly as practical with requirements specified for new work.

I. The cutting of pipe for inserting tees, fittings or closure pieces shall be done in a neat workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe. No pipe shall be laid in water or when, in the option of the Engineer trench conditions are unsuitable.

J. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without getting soil into it, the Engineer may require that before lowering the pipe into the trench, a temporary plug be placed over each end and left there until the connection is to be made to the adjacent pipe. During the laying operations, no debris, tools, clothing or other materials shall be left in the pipe.

K. At times when pipe laying is not in progress, the open ends of pipe shall be closed by watertight plug or other means approved by the Engineer. This provision shall apply

during the lunch-hour breaks as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

L. All grates, frames and covers for drain inlets, catch basins & trench drains shall be locked down to prevent theft after final construction.

3.2 FIELD INSPECTION FOR PIPE & FITTINGS

A. Television Inspection: The entire length of all new storm drain pipe 6" AND GREATER shall be inspected using Closed-Circuit Television (CCTV) equipment. The inspection shall be conducted after the line has been successfully installed, covered with bedding material, and prior to paving. The inspection shall be conducted in the presence of the Inspector. All labor and equipment necessary to conduct the CCTV inspection shall be furnished by the Contractor. CCTV inspection shall be per the following.

1. Record the inspection using a four-head, VHS format, video cassette recorder in standard play mode. Deliver the original videotapes, audio commentary, log sheets, and reports to the I.O.R. at the close of the each working day. As desired, the Contractor may produce duplicates for his own use. At the option of the Contractor, or request of the Owner, the video recordings may be converted to MPEG format and copied unto a DVD compatible with Microsoft software.

2. CCTV Equipment: Camera: Remote-controlled, focus from 6" to infinity. Resolution at 450 lines per inch, minimum. During the reinstatement of laterals, only use "rotating lens" or "pan and tilt" cameras. Footage counter: Accurate within ±1%. Include the real time counter measurement as a caption on the recorded tape. Use maintenance hole stations and maintenance hole numbers as references. Television monitor: Color, minimum 460 lines per inch resolution. Lighting: Adequate to fully illuminate the pipeline and positioned to not produce glare. Mobility: Capable of steadily traveling with or against the flow. The maximum speed while inspecting and recording is 9 m per minute (30 feet per minute).

3. Quality of CCTV Inspection Record: The recorded video image must clearly show the full circumference of the pipeline, in focus, with adequate lighting to see detail, with uniform and steady travel, and depicting the date and time of inspection, footage of travel, street, project title and pipe size. At laterals, service connections and pipe defects, provide a closer, more detailed examination and document the orientation, location and size. The written records must further describe those laterals, service connections and pipe defects and index them to their location on the video record.

4. Introduce water into the upstream end of the pipe for the required length of time such that the water flow leaving the pipe at the downstream end equals the flow entering the upstream end of the pipe. Discontinue water flow and perform the CCTV inspection of the pipe.

5. If debris is encountered, retrieve the CCTV unit, re-clean the pipeline and resume CCTV inspection. Pipe will be considered acceptable when the video camera records no ponding of water (except in joint recesses) within the pipe, no breaks in

the pipe and no openings or breaks at the joints, and the pipe is clean and free of dirt and debris. Remove and replace, or readjust to grade, any pipe failing to meet the acceptable video requirements.

6. At the completion of the video inspection, one copy of the tapes shall be turned over to the I.O.R.

7. Defects requiring correction include the following:
    1) Alignment: Less than full diameter of inside of pipe is visible between structures.
    2) Crushed, broken, cracked, or otherwise damaged piping.
    3) Exfiltration: Water leakage from or around piping.
    4) Infiltration: Water leakage into piping.

b. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

c. Re-inspect and repeat procedure until results are satisfactory.

END OF SECTION