PROJECT MANUAL

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ALTADENA ELEMENTARY SCHOOL

PLAYGROUND PROJECT

743 E Calaveras St., Altadena, CA 91001

DSA Approval

Pasadena Unified School District

LPA Project No.: 33366

SECTION 00002 - PROJECT DIRECTORY

Owner:

PASADENA UNIFIED SCHOOL DISTRICT
740 W. Woodbury Rf
Altadena, CA 91001
T- 626.396.5850

Contact:

Michael Dunning
Director of Facilities, Maintenance, Operations & Transportation

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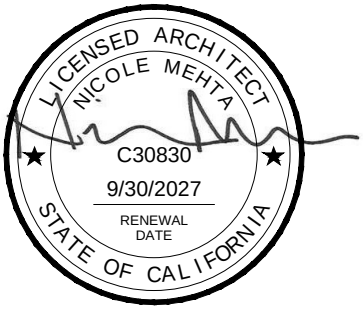
Architect:



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Contact:

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Architect of Record

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Contact:

Nestor C. Ignacio, Jr.
Electrical Engineer of Record

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-125900 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 03/18/2026

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END OF SECTION

SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project information.
B. Corrosive environment.
C. Deferred approvals.
D. Owner occupancy.
E. Contractor use of site and premises.

1.02 PROJECT INFORMATION

A. Project Name: Altadena Elementary School- Playground Project
B. Owner's Name: Pasadena Unified School District.
C. Architect's Name: LPA.
D. The Project consists of construction of new parking lot, photovoltaic structure and reconstruction of existing playground

1.03 CORROSIVE ENVIRONMENT

A. Corrosive Environments: Areas within approximately 10 miles of salt water or brackish water shorelines. These environments contain salts, including chloride, calcium chloride, and magnesium chloride; which are carried by sea spray, rain, fog, and dry salt particles in wind.
   1. Marine / Coastal Corrosive Environments: Areas immediately adjacent to salt or brackish water are the most damaging corrosive environment and require the highest level of protection.
B. This Project is:
   1. Not located within a corrosive environment. No special treatment of exterior metal is required.

1.04 DEFERRED APPROVALS

A. Deferred Approvals, General: Portions of the Work will not be submitted to the building official at the time of permit application.
   1. Refer to the Architectural drawings for a list of deferred approvals for this Project.
B. Construction of deferred approval items will not begin until documents have been approved by the building official and paid for by the Contractor.
   1. Submittal format and number of copies to be submitted to be coordinated by the Contractor with the building official.

1.05 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.
B. Owner intends to occupy a certain portion of the Project prior to the completion date for the conduct of normal operations.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
   1. Locate and conduct construction activities in ways that will limit disturbance to site.

B. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Existing building spaces may not be used for storage.

D. Nonsmoking Building: Smoking is not permitted within the building or 25 feet of entrances, operable windows, outdoor-air intakes.

E. Controlled Substances: Use of tobacco products and other controlled substances within the exisitng building is not permitted.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.
B. Documentation of changes in Contract Price and Contract Time.
C. Change procedures.
D. Correlation of Contractor submittals based on changes.
E. Procedures for preparation and submittal of application for final payment.

1.02 DEFINITIONS

A. Minor Change in the Work: A change which does not affect the Contract Sum or Contract Time.

1.03 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Project record documents.

1.04 SCHEDULE OF VALUES

A. Use Schedule of Values Form: As stipulated in the Agreement.
B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
C. Forms filled out by hand will not be accepted.
D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
E. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
F. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
G. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization and bonds and insurance.
H. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
I. Revise schedule to list approved Change Orders, with each Application For Payment.

1.05 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.
B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

E. Execute certification by signature of authorized officer.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

H. Submit three notarized copies of each Application for Payment.

I. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 013000.
   2. Construction progress schedule, revised and current as specified in Section 013000.
   3. Partial release of liens from major subcontractors and vendors.

J. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.06 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Price or Contract Time.
   2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change . Contractor shall prepare and submit a fixed price quotation within 15 working days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.

3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

F. Substantiation of Costs: Provide full information required for evaluation.
1. Provide the following data:
   a. Quantities of products, labor, and equipment.
   b. Taxes, insurance, and bonds.
   c. Overhead and profit.
   d. Justification for any change in Contract Time.
   e. Credit for deletions from Contract, similarly documented.
2. Support each claim for additional costs with additional information:
   a. Origin and date of claim.
   b. Dates and times work was performed, and by whom.
   c. Time records and wage rates paid.
   d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

J. Promptly enter changes in Project Record Documents.

1.07 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 017000.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Waivers.
5. Consent of Surety to final payment.
6. Evidence that claims have been settled.
7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
8. Final liquidated damages settlement statement.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 012501 - Substitution Request Form: Required form for substitution requests.
B. Section 013000 - Administrative Requirements: Submittal procedures, coordination.
C. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.
D. Section 016116 - Volatile Organic Compound (VOC) Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
    1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
        a. Unavailability.
        b. Regulatory changes.
    2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
        a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
    1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
    2. Agrees to provide the same warranty for the substitution as for the specified product.
    3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
    4. Waives claims for additional costs or time extension that may subsequently become apparent.
    5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

6. Will obtain necessary approval of agencies having jurisdiction.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms included in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:
   1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

B. Submittal Form (before award of contract):
   1. Submit substitution requests by completing the form attached to this section. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Should a Contractor-proposed substitution or alternative sequence or method of construction require revision of the Contract Drawings or Specifications, including revisions for the purposes of determining feasibility, scope or cost, or revisions for the purpose of obtaining review and approval by authorities having jurisdiction, revisions will be made by Architect or other consultant of the Owner who is the responsible design professional, as approved in advance by Owner's Representative.

B. Services of Architect, other responsible design professionals and Owner for researching and reporting on proposed substitutions or alternative sequence and method of construction shall be paid by Contractor when such activities are considered additional services to the design services contracts of Architect or other responsible design professional with Owner.

C. Costs of services by Architect, other responsible design professionals, and Owner shall be paid, including travel, reproduction, long distance telephone and shipping costs reimbursable at cost plus usual and customary mark-up for handling and billing. Such fees shall be paid whether or not the proposed substitution or alternative sequence or method of construction is ultimately accepted by Ownerct and a Change Order is executed.

D. Such fees shall be paid from Contractor's portion of savings, if a net reduction in Contract Sum results. If fees exceed Contractor's portion of net reduction, Contractor shall pay all remaining fees unless otherwise agreed in advance by Owner's Representative.

E. Submittal Form (after award of contract):
   1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

F. Architect will consider requests for substitutions only within 15 days after date of Agreement.

G. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

H. Submit request for Substitution for Convenience within 14 days of discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
   3. Bear the costs engendered by proposed substitution of:
      a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

I. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 012500.01

SUBSTITUTION REQUEST FORM

Project Name:	Job No.:
	Date:
To: Architect: LPA, Inc.	Contractor:
Specified Item:	

Specification Section	Paragraph No.	Drawing No.	Detail No.

Contractors Proposed Substitution:

Reason for Request: _____

_____

Manufacturer: _____

Manufacturer Contract: _____

Trade Name and Model: _____

History: ☐ New Product ☐ 1-4 Years in market ☐ 5-10 years in Market ☐ Over 11 years in market

Mandatory for Consideration: Specification Section 012500 – Substitution Procedures

☐ Drawings ☐ Product Data ☐ Samples ☐ Test Data ☐ Reports ☐ Other _____

Attach a **Point by Point Comparison** between proposed product and product indicated. Provide complete data for proposed product, including product/material descriptions, specifications, drawings, photographs, performance, MSDS data sheet and test data adequate for evaluation of the request. Clearly annotate applicable portions of the data. Include ICC Evaluation Service (ICC ES) Evaluation Report, if applicable.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equivalent or superior in all respects to specified product.
- Proposed substitution complies with applicable Codes, ordinances and standards.
- Proposed substitution complies with Contract requirements.
- Same warranty will be furnished for proposed substitution as specified products.
- Same maintenance service and source of replacement parts, as applicable, are available.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs cause by the substitution.

Submitted by: (name) _____ Title: _____

Signed: _____ Date: _____

SUBSTITUTION REQUEST

Architect's Recommended Action:

☐ **Approved.** Refer to the change document noted under Remarks below.

☐ **Rejected – Use specified product/material.**

Name: _____ Date: _____

Remarks: _____

_____

_____

_____

_____

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Electronic document submittal
C. Preconstruction meeting.
D. Site mobilization meeting.
E. Construction progress (OAC) meetings.
F. Construction progress schedule.
G. Contractor's daily reports.
H. Progress photographs.
I. Coordination drawings.
J. Requests for Interpretation (RFI).
K. Submittal procedures.
L. Delegated design.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section for coordination of execution of administrative tasks with timing of construction activities.
B. Make the following types of submittals to Architect:
    1. Requests for Interpretation (RFI).
    2. Requests for substitution.
    3. Shop drawings, product data, and samples.
    4. Test and inspection reports.
    5. Manufacturer's instructions and field reports.
    6. Applications for payment and change order requests.
    7. Progress schedules.
    8. Coordination drawings.
    9. Correction Punch List and Final Correction Punch List for Substantial Completion.
    10. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. It is Contractor's responsibility to submit documents in allowable format.
   3. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   4. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

3.02 PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
   4. Project Inspector.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, schedule of values, and progress schedule.
   5. Submission of initial Submittal schedule.
   6. Designation of personnel representing the parties to Contract and Architect.
   7. Procedures and processing of field decisions, RFIs, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   8. Scheduling.
   9. Critical work sequencing and long-lead items.
   10. Sustainable design requirements.
   11. Labor law requirements, including payment and reporting requirements.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

A. Schedule meeting at prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.

2. Owner.
3. Contractor's superintendent.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Work restrictions.
4. Work hours.
5. Construction facilities and controls provided by Owner.
6. Temporary utilities provided by Owner.
7. Survey and building layout.
8. Procedures for moisture and mold control.
9. Procedures for disruptions and shutdowns.
10. Construction waste management and recycling.
11. Parking availability.
12. Office, work, and storage areas.
13. Equipment deliveries and priorities.
14. First aid.
15. Security and housekeeping procedures.
16. Schedules.
17. Application for payment procedures.
18. Procedures for testing.
19. Procedures for maintaining record documents.
20. Requirements for start-up of equipment.
21. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS (OAC) MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum weekly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.

12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.05 **PROJECT CLOSEOUT CONFERENCE**

A. Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, Owner's Commissioing Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
      a. Preparation of record documents.
      b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
      c. Submittal of written warranties.
      d. Coordination of separate contracts.
      e. Owner's partial occupancy requirements.
      f. Installation of Owner's furniture, fixtures, and equipment.
      g. Responsibility for removing temporary facilities and controls.
   4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

3.06 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.07 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
   1. Date.
   2. High and low temperatures, and general weather conditions.
   3. List of subcontractors at Project site.
   4. Major equipment at Project site.

5. Material deliveries.
6. Safety, environmental, or industrial relations incidents.
7. Meetings and significant decisions.
8. Unusual events (submit a separate special report).
9. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
10. Directives and requests of authority having jurisdiction (AHJ).
11. Change Orders received and implemented.
12. Testing and/or inspections performed.
13. List of verbal instruction given by Owner and/or Architect.
14. Signature of Contractor's authorized representative.

3.08 PROGRESS PHOTOGRAPHS

A. Submit new photographs at least once a month, within 3 days after being taken.

B. Photography Type: Digital; electronic files.

C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

D. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of site clearing.
   2. Excavations in progress.
   3. Foundations in progress and upon completion.
   4. Structural framing in progress and upon completion.
   5. Mock-ups.
      a. Take photographs of all mock-ups required for Project scope.
      b. Take photographs of materials and assemblies that are both accepted and rejected by Owner and Architect.
   6. Teating and inspections.
      a. Take photographs of materials and assemblies which require testing and inspections.
      b. Pay special attention to items that will be concealed during further construction operations.
   7. Concealed Work.
      a. Before proceeding with installing Work that will conceal other Work, take photographs in sufficient number, with annotated descriptions, to record the nature and location of concealed Work. Including, but not limited to:
         1) Underslab utilities.
         2) Underslab services.
         3) Piping.
         4) Electrical conduit.
         5) Below-grade waterproofing.
         6) Weather barrier membranes.
         7) Roofing components.
   8. Fabrication, at locations away from Project site.

E. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Uploaded to Project web site.
   2. File Naming: Include project identification, date and time of view, and view identification.

3.09 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
      c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      f. Indicate required installation sequences.
      g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

3.10 REQUESTS FOR INFORMATION (RFIS)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Architect.
   6. RFI number, numbered sequentially.
   7. RFI subject.
   8. Specification Section number and title and related paragraphs, as appropriate.
   9. Drawing number and detail references, as appropriate.
   10. Field dimensions and conditions, as appropriate.
   11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012200 "Price and Payment Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

3.11 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule specified in Section - 013216 - Construction Progress Schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.
4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.12 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data. Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
   2. Shop drawings. Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
   3. Samples: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
      a. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
         1) Samples for selection.
         2) Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.13 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Sustainability design submittals and reports.
   3. Certificates.
   4. Test reports.
   5. Inspection reports.
   6. Manufacturer's instructions.
   7. Manufacturer's field reports.
   8. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.14 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section :
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.15 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Extra Copies at Project Closeout: See Section 017800.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.16 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Send submittals in electronic format via email to Architect.
   6. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
      c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional days.
   7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   8. Provide space for Contractor and Architect review stamps.
   9. When revised for resubmission, identify all changes made since previous submission.
   10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
   11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Submit concurrently with related shop drawing submittal.
   4. Do not submit (Material) Safety Data Sheets for materials or products.
   5. Submit sustainable design reporting submittals under separate cover.

C. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Do not reproduce Contract Documents to create shop drawings.
   3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:

1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

E. Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

F. Submittal number or other unique identifier, including revision identifier.
1. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

G. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

H. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

3.17 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Reviewed", or language with same legal meaning.
1) No corrections noted.
b. "Make Corrections Noted", or language with same legal meaning.
1) Incorporate review notations, resubmission not required.
2. Not Authorizing purchasing, fabrication, delivery, and installation:
a. "Revise and Resubmit", or language with same legal meaning.
1) Submittal is incomplete and / or needs corrections.
2) Resubmit, with all required components and with review notations acknowledged and incorporated.
3) Non-responsive resubmittals may be rejected.
b. "Submit Specified Item", or language with same legal meaning.
1) Provide new submittal with item specified in Project Manual or drawings.

2) Substitutions not permitted.

c. "Rejected", or language with same legal meaning.

1) Submit item complying with requirements of Contract Documents.

d. "Not Reviewed", or language with same legal meaning.

E. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:
   a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
   a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 013000.01

REQUEST FOR INTERPRETATION

Project Name:		Job No.:	
		RFI No:	
To: Architect: LPA, Inc.		Contractor:	
Subject:			
Specification Section	**Paragraph No.**	**Drawing No.**	**Detail No.**

Category:

- ☐ Need for Clarification.
- ☐ Unforeseen Condition.
- ☐ Conflict Within Documents.
- ☐ Coordination Problem.
- ☐ Other.

Description:

Contractor's Proposed Resolution:

- ☐ Attachments:
- ☐ Estimated Cost Impact" $
- ☐ Estimated Time Impact:

Contactor Signature: Date:

Architect's Response:

Refer to RFI procedures specified in Section 013100 – Project Management and Coordination. This RFI, when completed is not authorization for change to the Contract Documents. Changes to the Contract Documents are authorized only by properly executed Construction Change Directives or Change Order.

- ☐ Attachments:

Architect's Signature: Date:

SECTION 013000.02 – DIGITAL DATA REQUEST FORM

From (Requestor): _____ DRC NO.: _____ Date: _____

_____ Project: _____

_____ Project No: _____

_____ Location: _____

Attn: _____ Description: _____

Phone: _____ _____

Fax: _____ _____

Execution of this document will confirm your request for copies of digital files related to the above referenced project. Please complete the following section and return a signed copy of this form via fax or mail with payment to LPA.

DESCRIPTION OF DOCUMENTATION REQUESTED:

Type of Files Needed:

_____ DWG (AutoCAD Native)

_____ DWF (AutoCAD Design Web)

_____ DXF (AutoCAD Drawing Exchange)

Purpose of Request: _____

If Requestor is a subcontractor to the Project's General Contractor, please indicate the name and phone number of contact at General Contractor's office:

Name: _____ Number: _____

If Requestor is a consultant to the project's owner, please indicate the name and phone number of contact at owner's office:

Name: _____ Number: _____

LPA can only release electronic files to the Project's Owner, consultants to the Project's Owner and/or the Project's General Contractor. A written statement by the Project's General Contractor authorizing LPA to release documentation to a subcontractor of the General Contractor must accompany this request. Please be advised that, in case of existing construction, the documents requested are reproductions of documentation on file and do not necessarily represent as-built or existing conditions. LPA does not warrant in any way the accuracy of this information and shall not be responsible for any discrepancy between this documentation and the existing conditions. In the case of projects which are currently being designed and/or under construction, the electronic documentation are reproductions of the documentation on file and may be subject to change due to owner, field and/or coordination revisions. LPA shall not be responsible for reissuing files which may me revised after issuance of these requested files and shall not be responsible for advising other parties as to the status of document revisions. Also, please be advised that the requested documents are instruments of service and, as such, remain the property of LPA and/or the respective consultant. Any unauthorized re-use of these documents without the written authorization of LPA and/or consultant is strictly prohibited. Please note all disclaimers and warnings printed on electronic media labels. Electronic media may contain undetected viruses. It is always recommended that disks be checked prior to use. LPA assumes no liability or responsibility for damage to user's property as a result of using this request may include archive storage and retrieval, charges, reproduction and handling expenses, etc., which are estimated to be, but may exceed $0.00. The exact cost will be determined by LPA upon execution of this request confirmation

The basic charge for copying/translating DWG (AUTOCAD), DWF or DXF files is $100 per drawing.

_____ Payment of these costs must be made by the requestor to LPA, Inc. prior to release of the documents.

_____ The requested files shall be provided at the direction of the Owner. No charge to Requestor.

By signing this Request, the Requestor agrees to the conditions for reimbursement to LPA, Inc. as stated above.

Authorized Signature: _____ Date: _____

Please return one fully executed copy of this form to: LPA, Inc.
(Offices in Irvine, San Diego, San Jose, & Sacramento, CA and San Antonio, TX)

SECTION 013000.03

SUBMITTAL COVER SHEET

Project Name: **LPA, Inc. Project No.:**	**Resubmittal** ☐ **Yes** **Add "letter" to original number**	**Submittal No:**
SUBCONTRACTOR: **Name:** **Address:** **Phone:** **Contact:**	**CONTRACTOR:** **Name:** **Signed:** **Dates:** **I hereby certify that I have reviewed the attached, have verified requirements and compliance with the Contract Documents.**	
Submittal Description:	**Specification Section:**	
Date Received From Contractor:	**Specification Section:**	
Consultant Review: ☐ **Civil** ☐ **Electrical** ☐ **Mechanical** ☐ **Structural** ☐ **Other:** _____ **Date sent to consultant:** _____ **Date received from consultant:** _____	**Copies:** ☐ **Contractor** ☐ **Inspector** ☐ **LPA File** ☐ **Owner** ☐ **Other:** _____	

Review and commentary noted below are only for general conformance with (1) The design concept of the project and (2) The information given in the contract documents and for no other purpose. Commentary below is subject to the requirements of the contract documents. The contractor is not relieved from responsibility for any deviation from the requirements of the contract documents, errors or omissions in drawings, calculations or samples, confirmation and correlation of dimensions at the job site, fabrication process and techniques of construction, coordination of his work with that of all other trades and satisfactory performance of his work.

☐ **Reviewed** ☐ **Furnish as corrected** ☐ **Revise and Resubmit**	☐ **Contractor** ☐ **Inspector**
Reviewed by:	**Date:**
Remarks:	

SECTION 013216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.03 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; 2016, with Addendum (2021).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Within 10 days after date of Agreement, submit preliminary schedule.

C. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

D. Within 20 days after review of preliminary schedule, submit draft of proposed complete Critical Path Method schedule for review.

E. Within 10 days after joint review, submit complete Critical Path Method schedule.

F. Submit updated schedule with each Application for Payment.

G. Submit in PDF format.

1.05 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.06 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Include conferences and meetings in schedule.

E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

F. Indicate delivery dates for owner-furnished products.

G. Coordinate content with schedule of values specified in Section 012000 - Price and Payment Procedures.

H. Provide legend for symbols and abbreviations used.

3.03 PRELIMINARY SCHEDULE BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. Quality assurance.
C. References and standards.
D. Testing and inspection agencies and services.
E. Contractor's construction-related professional design services.
F. Contractor's design-related professional design services.
G. Control of installation.
H. Mock-ups.
I. Tolerances.
J. Manufacturers' field services.
K. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures.
B. Section 014216 - Definitions.

1.03 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025.

1.04 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.
B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
    1. Design Services Types Required:
        a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.
        b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.
C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

D. Experienced: When used with an entity or individual, "experienced", unless otherwise further described, means:
   1. Having successfully completed a minimum of five previous projects similar in nature, size, and extent of this Project.
   2. Bring familiar with special requirements indicated.
   3. Having complied with requirements of authorities having jurisdiction.

E. Mock-ups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
   1. Mockups are used for one or more of the following:
      a. Verify selections made under Sample submittals.
      b. Demonstrate aesthetic effects.
      c. Demonstrate the qualities of products and workmanship.
      d. Demonstrate successful installation of interfaces between components and systems.
      e. Perform preconstruction testing to determine system performance.

F. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

G. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary falsework for support of spanning or arched structures.
   5. foundation underpinning.
   6. Temporary stairs or steps required for construction access only.
   7. Temporary hoist(s) and rigging.
   8. Investigation of soil conditions to support construction equipment.

1.06 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.
   1. Submit a Request for to Architect if the criteria indicated are not sufficient to perform required design services.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.

1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
    a. Full name.
    b. Professional licensure information.
    c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
2. Include required product data and shop drawings.
3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

D. Mock-up Shop Drawings:
1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

E. Contractor's Quality Control (CQC) Plan.

F. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
1. Include:
    a. Date issued.
    b. Project title and number.
    c. Name of inspector.
    d. Date and time of sampling or inspection.
    e. Identification of product and specifications section.
    f. Location in the Project.
    g. Type of test/inspection.
    h. Date of test/inspection.
    i. Results of test/inspection.
    j. Compliance with Contract Documents.
    k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

G. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

H. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

I. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
   1. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

C. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
   1. Requirements of Authorities Having Jurisdiction supersede requirements for specialists.

D. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

E. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.09 CONTRACTOR'S QUALITY CONTROL (CQC) PLAN

A. Contractor's Quality Control (CQC) Plan:
   1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
      a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
         1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
      b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
         1) Management and control of documents and records relating to quality.
         2) Communications.
         3) Coordination procedures.
         4) Resource management.
         5) Process control.
         6) Inspection and testing procedures and scheduling.
         7) Control of noncomplying work.
         8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
         9) Control of testing and measuring equipment.
         10) Project materials certification.

11) Managerial continuity and flexibility.

c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.

d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

B. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.10 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on , except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

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

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.11 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

C. Project Inspector: A Class II Project Inspector employed by the District and approved by DSA, providing continuous inspection per Title 24 CCR, Part 1, Section 4-333. The duties of the Project Inspector are defined in Title 24 CCR, Part 1, Section 4-342. “Special Inspector” and “Inspector of Record” shall mean the same as Project Inspector.

1.12 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.

4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

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

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

J. Where possible salvage and recycle the demolished mock-up materials.

3.03 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor's Responsibilities:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
      e. When testing is complete, remove test specimens. Do not reuse on Project.
   2. Testing Agency's Responsibilities:
      a. Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor.
      b. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

3.04 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.05 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.

3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
a. To provide access to Work to be tested/inspected.
b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
c. To facilitate tests/inspections.
d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.06 MANUFACTURERS' FIELD SERVICES

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

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

3.07 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 014113.11
REGULATORY REQUIREMENTS - GLOBAL WARMING POTENTIAL (GWP)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mandatory requirements for maximum allowable global warming potential (GWP) value of products.

1.02 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: Additional sustainable product requirements.

1.03 DEFINITIONS

A. Embodied Carbon: The sum of greenhouse gas (GHG) emissions arising from the manufacturing, transportation, installation, maintenance, and disposal of building materials. Embodied carbon is expressed as Global Warming Potential (GWP).

B. Environmental Product Declaration (EPD): A document which quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function. EPDs are conducted in accordance with a Product Category Rule (PCR) for the specific product being evaluated. EPDs are available as Industry-Wide EPDs (IW-EPD) or Factory / Product Specific EPDs.
   1. Type III EPDs are third-party verified and compliant with the ISO 14025 standard.

C. Global Warming Potential (GWP): The heat absorbed by any greenhouse gas in the atmosphere as a multiple of the heat that would be absorbed by the same mass of carbon dioxide, usually over a 100-year period. GWP is reported as carbon dioxide equivalent (CO_2e).

D. Life Cycle Assessment (LCA): A methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.

E. Product Category Rules (PCR): A set of rules, requirements, and guidelines for developing Environmental Product Declarations (EPD) for one or more categories.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal requirements.

B. Sustainable Product Data: See Section 01 6000 - Product Requirements.
   1. Life Cycle Data: Provide Type III environmental product declarations (EPD) for products listed in Part 2 of this Section but specified in other Sections.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS - GLOBAL WARMING POTENTIAL (GWP)

A. CBC 5.409.3 Product GWP Compliance: Permanently installed products listed in this Section must have a Type III environmental product declaration (EPD), either product-specific or factory-specific, showing compliance with the maximum allowable GWP value specified.

B. Concrete Reinforcement: See Structural drawings and Section 032000 - Concrete Reinforcing for maximum allowable GWP values for the following:
   1. Deformed bar reinforcing steel.

C. Concrete: See Structural drawings and Section 033000 - Cast-in-Place Concrete for maximum allowable GWP values for the following:
   1. Ready-mixed concrete.
   2. Lightweight ready-mixed concrete.

D. Steel: See Structural drawings and Section 051200 - Structural Steel Framing for maximum allowable GWP values for the following:
   1. Hot-rolled structural steel.
   2. Hollow structural sections.
   3. Steel plate.

E. Flat Glass:
   1. Maximum Allowable GWP Value: 2.50 kg CO_2e/MT.

F. Light-Density Mineral Wool Board Insulation:
   1. Maximum Allowable GWP Value: 5.83 kg CO_2e/l m^2.

G. Heavy-Density Mineral Wool Board Insulation:
   1. Maximum Allowable GWP Value: 14.28 kg CO2e/l m^2.

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 014216
DEFINITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Definitions.
   1. Other definitions are included in individual specification sections.
B. Industry standards.
C. Abbreviations and acronyms.

1.02 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.
B. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
C. Directed: A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed".
D. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated".
E. Furnish: To supply, deliver, unload, and inspect for damage.
F. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
G. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
H. Project Site: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
I. Provide: To furnish and install, complete and ready for the intended use.
J. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
K. Reviewed: When used to convey Architect's action on Contractor's submittals, applications, and requests, "reviewed" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
L. Supply: Same as Furnish.

1.03 TECHNICAL DEFINITIONS

A. Air Barrier Material: Materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.004 cfm/ft2 @ 1.57 psf), when tested in accordance with ASTM E2178 (unmodified).

1. Vapor-Permeable Air Barrier Material: A material that meets the requirements of an air barrier material, but allows the passage of water vapor, to reduce the possibility of moisture build-up within an assembly.
2. Vapor-Impermeable Air Barrier Material: Restricts the passage of both air and water vapor.

B. Air Barrier System: A combination of approved air barrier materials, sealed together to prevent leakage of conditioned air from the building. The air barrier must be continuous over the entire exterior of the building:
1. Wall air barrier materials must seal to roof air barrier materials, or both materials must seal to a common third air barrier material, such as stainless steel.
2. All air barrier materials must be sealed to all window, door, skylight, and other exterior openings and penetrations.
3. Windows, doors, and skylights must meet requirements for maximum air leakage.
4. All building expansion joints require air barrier materials that allow movement to bridge the expansion joint.

C. Hydrostatic Pressure: Force exerted by water. Below-grade hydrostatic pressure can be caused by the presence of rainwater, irrigation water, high water table, rising water vapor, or a combination of these sources. The ability of the soil to drain water will impact the amount of hydrostatic pressure.

D. Sealant Failure:
1. Adhesive Failure: Sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive Failure: Sealant breaks or tears within itself but does not separate from each substrate.

E. Vapor Retarder: A material or system of materials which prevent the transmission of water vapor, between 1.0 and 0.1 perm, without hydrostatic pressure.

F. Vapor Barrier: A material or system of materials which prevent the transmission of water vapor, less than 0.1 perm, without hydrostatic pressure.

G. Waterproofing: A material or system of materials which prevent the transmission of liquid water under hydrostatic pressure.
1. Positive-Side Waterproofing: Outside of the building envelope.
2. Negative-Side Waterproofing: Within the building envelope.

1.04 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.05 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States".

B. Industry Organizations, List: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. AABC - Associated Air Balance Council; www.aabc.com.
   2. AAMA - American Architectural Manufacturers Association; (see FGIA).
   3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
   4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
   5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
   6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
   7. ABMA - American Boiler Manufacturers Association; www.abma.com.
   8. ACI - American Concrete Institute; www.concrete.org.
   9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
   10. ACPA - American Concrete Pipe Association; www.concretepipe.org.
   11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
   12. AF&PA - American Forest & Paper Association; www.afandpa.org.
   13. AGA - American Gas Association; www.aga.org.
   14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
   15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
   16. AI - Asphalt Institute; www.asphaltinstitute.org.
   17. AIA - American Institute of Architects (The); www.aia.org.
   18. AISC - American Institute of Steel Construction; www.aisc.org.
   19. AISI - American Iron and Steel Institute; www.steel.org.
   20. AITC - American Institute of Timber Construction; (see PLIB).
   21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
   22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
   23. ANSI - American National Standards Institute; www.ansi.org.
   24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyzeseeds.com.
   25. APA - The Engineered Wood Association; www.apawood.org.
   26. APA - Architectural Precast Association; www.archprecast.org.
   27. API - American Petroleum Institute; www.api.org.
   28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
   29. ASA - Acoustical Society of America; www.acousticalsociety.org.
   30. ASCE - American Society of Civil Engineers; www.asce.org.
   31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (see ASCE).
   32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
   33. ASME - ASME International; American Society of Mechanical Engineers (The); www.asme.org.
   34. ASSE - ASSE International; (American Society of Sanitary Engineering); www.asse-plumbing.org.
   35. ASSP - American Society of Safety Professionals; www.assp.org.

36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - Business and Institutional Furniture Manufacturer's Association; www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; www.bwfbadminton.com.
50. CARB - California Air Resources Board; www.arb.ca.gov.
51. CDA - Copper Development Association Inc.; www.copper.org.
52. CE - Conformite Europeenne (European Commission); www.ec.europa.eu/growth/single-market/ce-marking.
53. CEA - Canadian Electricity Association; www.electricity.ca.
54. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
55. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
56. CGA - Compressed Gas Association; www.cganet.com.
57. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
58. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
59. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
60. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
61. CPA - Composite Panel Association; www.compositepanel.org.
62. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
63. CRRC - Cool Roof Rating Council; www.coolroofs.org.
64. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
65. CSA - CSA Group; www.csagroup.org.
66. CSI - Cast Stone Institute; www.caststone.org.
67. CSI - Construction Specifications Institute (The); www.csiresources.org.
68. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
69. CTA - Consumer Technology Association; www.cta.tech.
70. CTI - Cooling Technology Institute; www.coolingtechnology.org.
71. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
72. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
73. DHI - Door and Hardware Institute; www.dhi.org.
74. ECIA - Electronic Components Industry Association; www.ecianow.org.
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. EOS/ESD - EOS/ESD Association, Inc.; Electrostatic Discharge Association; www.esda.org.
78. ESTA - Entertainment Services and Technology Association; www.esta.org.
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FGIA - Fenestration and Glazing Industry Alliance; https://fgiaonline.org.
82. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.

83. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
84. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
85. FM Global - FM Global; www.fmglobal.com.
86. FRSA - Florida Roofing and Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
87. FSA - Fluid Sealing Association; www.fluidsealing.com.
88. FSC - Forest Stewardship Council U.S.; www.fscus.org.
89. GA - Gypsum Association; www.gypsum.org.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HMMA - Hollow Metal Manufacturers Association; (see NAAMM).
93. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
94. IAS - International Accreditation Service; www.iasonline.org.
95. ICC - International Code Council; www.iccsafe.org.
96. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
97. ICPA - International Cast Polymer Association (The); www.theicpa.com.
98. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
99. IEC - International Electrotechnical Commission; www.iec.ch.
100. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
101. IES - Illuminating Engineering Society; www.ies.org.
102. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
103. IGMA - Insulating Glass Manufacturers Alliance; (see FGIA).
104. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
105. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
106. Intertek - Intertek Group; www.intertek.com.
107. ISA - International Society of Automation (The); www.isa.org.
108. ISFA - International Surface Fabricators Association; www.isfanow.org.
109. ISO - International Organization for Standardization; www.iso.org.
110. ITU - International Telecommunication Union; www.itu.int.
111. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
112. LPI - Lightning Protection Institute; www.lightning.org.
113. MBMA - Metal Building Manufacturers Association; www.mbma.com.
114. MCA - Metal Construction Association; www.metalconstruction.org.
115. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
116. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
117. MHI - Material Handling Industry; www.mhi.org.
118. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
119. MPI - Master Painters Institute; www.paintinfo.com.
120. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.; www.msshq.org.
121. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
122. NACE - NACE International; (National Association of Corrosion Engineers International); (see AMPP).
123. NADCA - National Air Duct Cleaners Association; www.nadca.com.
124. NAIMA - North American Insulation Manufacturers Association; www.insulationinstitute.org.
125. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
126. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
127. NBI - New Buildings Institute; www.newbuildings.org.

128. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
129. NCMA - National Concrete Masonry Association; www.ncma.org.
130. NEBB - National Environmental Balancing Bureau; www.nebb.org.
131. NECA - National Electrical Contractors Association; www.necanet.org.
132. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
133. NEMA - National Electrical Manufacturers Association; www.nema.org.
134. NETA - InterNational Electrical Testing Association; www.netaworld.org.
135. NFHS - National Federation of State High School Associations; www.nfhs.org.
136. NFPA - National Fire Protection Association; www.nfpa.org.
137. NFPA - NFPA International; (see NFPA).
138. NFRC - National Fenestration Rating Council; www.nfrc.org.
139. NGA - National Glass Association; www.glass.org.
140. NHLA - National Hardwood Lumber Association; www.nhla.com.
141. NLGA - National Lumber Grades Authority; www.nlga.org.
142. NOFMA - National Oak Flooring Manufacturers Association; (see NWFA).
143. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
144. NRCA - National Roofing Contractors Association; www.nrca.net.
145. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
146. NSF - NSF International; www.nsf.org.
147. NSI - Natural Stone Institute; www.naturalstoneinstitute.org.
148. NSPE - National Society of Professional Engineers; www.nspe.org.
149. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
150. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
151. NWFA - National Wood Flooring Association; www.nwfa.org.
152. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
153. PCI - Precast / Prestressed Concrete Institute; www.pci.org.
154. PDI - Plumbing & Drainage Institute; www.pdionline.org.
155. PLASA - PLASA; www.plasa.org.
156. PLIB - Pacific Lumber Inspection Bureau; www.plib.org.
157. PVCPA - Uni-Bell PVC Pipe Association; www.uni-bell.org.
158. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
159. RFCI - Resilient Floor Covering Institute; www.rfci.com.
160. RIS - Redwood Inspection Service; (see WWPA).
161. SAE - SAE International; www.sae.org.
162. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
163. SDI - Steel Deck Institute; www.sdi.org.
164. SDI - Steel Door Institute; www.steeldoor.org.
165. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
166. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (see ASCE).
167. SIA - Security Industry Association; www.securityindustry.org.
168. SJI - Steel Joist Institute; www.steeljoist.org.
169. SMA - Screen Manufacturers Association; www.smainfo.org.
170. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
171. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
172. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
173. SPIB - Southern Pine Inspection Bureau; www.spib.org.
174. SPRI - Single Ply Roofing Industry; www.spri.org.
175. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.

176. SSINA - Specialty Steel Industry of North America; www.ssina.com.
177. SSPC - SSPC: The Society for Protective Coatings; (see AMPP).
178. STI/SPFA - Steel Tank Institute/Steel Plate Fabricators Association; www.steeltank.com.
179. SWI - Steel Window Institute; www.steelwindows.com.
180. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
181. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
182. TCNA - Tile Council of North America, Inc.; www.tcnatile.com.
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.kbcdco.tema.org.
184. TIA - Telecommunications Industry Association (The); www.tiaonline.org.
185. TMS - The Masonry Society; www.masonrysociety.org.
186. TPI - Truss Plate Institute; www.tpinst.org.
187. TPI - Turfgrass Producers International; www.turfgrasssod.org.
188. TRI - Tile Roofing Industry Alliance; www.tileroofing.org.
189. UL - Underwriters Laboratories Inc.; www.ul.org.
190. UL LLC - UL LLC; www.ul.com.
191. USAV - USA Volleyball; www.usavolleyball.org.
192. USGBC - U.S. Green Building Council; www.usgbc.org.
193. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
194. WA - Wallcoverings Association; www.wallcoverings.org.
195. WCLIB - West Coast Lumber Inspection Bureau; (see PLIB).
196. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
197. WDMA - Window & Door Manufacturers Association; www.wdma.com.
198. WI - Woodwork Institute; www.woodworkinstitute.com.
199. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
200. WWPA - Western Wood Products Association; www.wwpa.org.

C. Abbreviations and acronyms not included in this list are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States".

D. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
   1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
   2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
   3. ICC - International Code Council; www.iccsafe.org.
   4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

E. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
   1. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
   2. DOC - U.S. Department of Commerce; www.commerce.gov.
   3. DOD - U.S. Department of Defense; www.defense.gov.
   4. DOE - U.S. Department of Energy; www.energy.gov.
   5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov
   6. DOS - U.S. Department of State; www.state.gov.
   7. EPA - United States Environmental Protection Agency; www.epa.gov.
   8. FAA - Federal Aviation Administration; www.faa.gov.
   9. GPO - U.S. Government Publishing Office; www.gpo.gov.
   10. GSA - U.S. General Services Administration; www.gsa.gov.
   11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.

12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.

F. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. CFR - Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.
   2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
   3. DSCC - Defense Supply Center Columbus; (see FS).
   4. FED-STD - Federal Standard; (see FS).
   5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
      a. Available from Defense Standardization Program; www.dsp.dla.mil.
      b. Available from U.S. General Services Administration; www.gsa.gov.
      c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
   6. MILSPEC - Military Specification and Standards; (see DOD).
   7. USAB - United States Access Board; www.access-board.gov.
   8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

G. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).
   2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation); www.bhgs.dca.ca.gov.
   3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
   4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
   5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
   6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
   7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; https://tfsweb.tamu.edu/.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering

B. Temporary Controls: Barriers, enclosures, and fencing.

C. Temporary facility use.

1.02 RELATED REQUIREMENTS

A. Section 015100 - Temporary Utilities.

B. Section 015213 - Field Offices and Sheds.

C. Section 015500 - Vehicular Access and Parking.

D. Section 015813 - Temporary Project Signage.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

D. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.04 DEWATERING

A. Provide temporary means and methods for dewatering all temporary facilities and controls.

B. Maintain temporary facilities in operable condition.

C. Maintain temporary facilities as directed by Architect.

1.05 TEMPORARY BARRIERS AND ENCLOSURES, GENERAL

A. Accessible Temporary Egress: Comply with applicable provisions in ADA Standards and ICC A117.1.

B. Materials: Refer to Part 2 of this Section.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular gates with locks.

1.08 TEMPORARY EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.09 TEMPORARY INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.10 TEMPORARY FACILITY USE

A. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

B. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

C. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

1.11 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, and with 1-5/8-inch OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide concrete bases for supporting posts.

C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.

E. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

F. Temporary Enclosure Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 015100
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.
B. Temporary sanitary facilities.
C. Removal of temporary utilities.

1.02 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

1.03 TEMPORARY UTILITIES, GENERAL

A. New permanent facilities may be used.
B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TEMPORARY ELECTRICITY

A. Provide temporary electric feeder from existing building electrical service at location as directed.
B. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
C. Provide main service disconnect and over-current protection at convenient location and meter.
D. Permanent convenience receptacles may be utilized during construction.
E. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
C. Maintain lighting and provide routine repairs.
D. Permanent building lighting may be utilized during construction.

1.06 TEMPORARY WATER SERVICE

A. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

1.07 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

1.08 REMOVAL OF TEMPORARY UTILITIES

A. Remove temporary utilities prior to Date of Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 015213
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary field offices and sheds.

1.02 RELATED REQUIREMENTS

A. Section 015000 - Temporary Facilities and Controls:
B. Section 015000: Parking and access to field offices.

PART 2 PRODUCTS

2.01 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

2.02 MATERIALS, EQUIPMENT, FURNISHINGS

A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.03 CONSTRUCTION

A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.
C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy requirements.
D. Exterior Materials: Weather resistant, finished .
E. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.04 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

PART 3 EXECUTION

3.01 PREPARATION

A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

3.03 MAINTENANCE AND CLEANING

A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.

B. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

SECTION 015500
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access roads.
B. Parking.
C. Permanent pavements and parking facilities.
D. Construction parking controls.
E. Flag persons.
F. Haul routes.
G. Maintenance.
H. Removal, repair.
I. Mud from site vehicles.
J. Dust control.

PART 2 PRODUCTS

2.01 MATERIALS

A. Temporary Construction: Contractor's option.
B. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base, and topping.

PART 3 EXECUTION

3.01 VEHICULAR ACCESS AND PARKING, GENERAL

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
B. Coordinate access and haul routes with governing authorities and Owner.
C. Provide and maintain access to fire hydrants, free of obstructions.
D. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

3.02 PREPARATION

A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

3.03 PARKING

A. Do not allow heavy vehicles or construction equipment in parking areas.

3.04 PERMANENT PAVEMENTS AND PARKING FACILITIES

A. Prior to Substantial Completion the base for permanent roads and parking areas may be used for construction traffic.

B. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.05 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.06 FLAG PERSONS

A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.07 HAUL ROUTES

A. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.08 MAINTENANCE

A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.

B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.09 REMOVAL, REPAIR

A. Remove temporary roads when permanent paving is usable.

B. Remove equipment and devices when no longer required.

C. Repair damage caused by installation.

3.10 MUD FROM SITE VEHICLES

A. Provide means of removing mud from vehicle wheels before entering streets.

3.11 **DUST CONTROL**

A. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

END OF SECTION

SECTION 015639
TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Tree protection of existing trees and plants

B. Tree pruning of existing trees

1.02 RELATED REQUIREMENTS

A. Section 015000 - Temporary Facilities and Controls.

B. Section 311000 - Site Clearing.

C. Section 329300 - Landscape Work.

1.03 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at 6 inches (150 mm) above the ground for trees up to, and including, 4-inch (100-mm) size; and 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of the following:
   1. Organic Mulch: 1-pint (0.5-L) 1-quart (1-L) volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
   2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
   3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
   1. Species and size of tree.
   2. Location on site plan. Include unique identifier for each.
   3. Reason for pruning.
   4. Description of pruning to be performed.
   5. Description of maintenance following pruning.

D. Qualification Data: For qualified arborist and tree service firm.

E. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

F. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

G. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
   1. Use sufficiently detailed photographs or videotape.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.05 QUALITY ASSURANCE

A. Arborist Qualifications:
   1. Certified Arborist as certified by ISA.
   2. Licensed Arborist in jurisdiction where Project is located.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
      a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
      b. Enforcing requirements for protection zones.
      c. Arborist's responsibilities.
      d. Contractor responsibilities
      e. Field quality control.

1.06 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or trenching or digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
   8. Do not direct vehicle or equipment exhaust toward protection zones.
   9. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) Insert dimension in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.
2. Refer to Section 32 Landscape Work for material requirements.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
1. Type: Wood and bark chips.
2. Size Range: 1-1/2" inch minimum, 3" maximum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements. Previously used materials may be used when approved by Architect.
1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch (50-mm) opening, 0.148-inch- (3.76-mm-) diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- (60-mm-) OD line posts, and 2-7/8-inch- (73-mm-) OD corner and pull posts; with 1-5/8-inch- (42-mm-) OD top rails and 0.177-inch- (4.5-mm-) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
a. Height: 6 feet (1.8 m).
b. Galvanized
c. Polymer-Coating Color: Black.
2. Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches (914 mm) .

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:
1. Size: as required
2. Text: "TREE PROTECTION ZONE - KEEP OUT. No unauthorized entry. No storage of vehicles, materials, or debris. No dumping of chemicals, slurry, paint, oil, etc. "
3. Lettering: 3-inch (75-mm-)high minimum, black characters on white background.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.02 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag - Tie a 1-inch (25-mm) blue-vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
1. Apply 3-inch (76-mm) average thickness of organic mulch. Do not place mulch within 6 inches (152 mm) of tree trunks.

3.03 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
   1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
   2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
   3. Access Gates: Install as required; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet (10.5 m) on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
   1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
   2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.04 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "Earth Moving."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only roots smaller than 2” in diameter that interfere with installation of utilities. Cut roots as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.05 ROOT PRUNING

A. Do Not prune any roots without written authorization from Arborist or Client.

B. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
   1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
   2. Cut Ends: Do not paint cut root ends. Coat cut ends of roots more than 1-1/2 inches (38 mm) in diameter with emulsified asphalt or other coating formulated for use on damaged plant tissues as approved by the arborist.
   3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   4. Cover exposed roots with burlap and water regularly.
   5. Backfill as soon as possible according to requirements in Division 31 Section "Grading"

C. Root Pruning at Edge of Protection Zone: Prune roots 12 inches (300 mm) outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

D. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.06 CROWN PRUNING

A. Do not prune any branches without written authorization from Arborist or Client.

B. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:
   1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
   2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:
      a. Type of Pruning: Cleaning Thinning Raising Reduction.
   3. Cut branches with sharp pruning instruments; do not break or chop.
   4. Do not apply pruning paint to wounds.

C. Chip removed branches and dispose of off-site.

3.07 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
   1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 4 inches (50 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.08 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.09 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
   1. Submit details of proposed root cutting and tree and shrub repairs.
   2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
   3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
   4. Perform repairs within 24 hours.
   5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 66 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
   1. Provide new trees of same size and species as those being replaced for each tree that measures 4 inches (100 mm) or smaller in caliper size.
   2. Provide one new tree(s) of 6-inch (150-mm) caliper size for each tree being replaced that measure more than 4 inches (100 mm) in caliper size.
      a. Species: Species selected by Architect.
   3. Plant and maintain new trees as specified in Division 32 Section "Landscape Work"

C. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) O.C. Backfill holes with an equal mix of native soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 015713
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

B. Section 311000 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.

C. Section 312200 - Grading: Temporary and permanent grade changes for erosion control.

D. Section 321500 - Aggregate Surfacing: Temporary and permanent roadways.

1.03 REFERENCE STANDARDS

A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus; 2021.

B. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2022.

C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015 (Reapproved 2023).

D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a (Reapproved 2023).

E. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile; 2021a.

F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017 (Reapproved 2021).

G. California State Water Resources Control Board, Construction General Permit; current edition.

H. California Stormwater Quality Association (CASQA), California Stormwater Best Management Practice (BMP) Handbook; current edition.

I. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.

J. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 2015.

1.04 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of _____ for erosion and sedimentation control .

B. Best Management Practices Standard: CASQA Stormwater BMP Handbook.

C. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
   1. Owner will obtain permits and pay for securities required by authority having jurisdiction.
   2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.

D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

J. Open Water: Prevent standing water that could become stagnant.

K. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan:
   1. Submit within 2 weeks after Notice to Proceed.

2. Include:
    a. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
    b. Schedule of temporary preventive measures, in relation to ground disturbing activities.
    c. Other information required by law.
    d. Format required by law is acceptable, provided any additional information specified is also included.
3. Obtain the approval of the Plan by Owner.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

D. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mulch: Use one of the following:
1. Straw or hay.
2. Erosion control matting or netting.
3. Polyethylene film, where specifically indicated only.

B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Bales: Air dry, rectangular straw bales.

D. Bale Stakes: One of the following, minimum 3 feet long:
1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.
2. Wood, 2 by 2 inches in cross section.

E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491/D4491M.
3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
4. Tensile Strength: 100 pounds-force, minimum, in cross-machine direction; 124 pounds-force, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
6. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

F. Silt Fence Posts: One of the following, minimum 5 feet long:
1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.

G. Gravel: See Section 312323 for aggregate.

H. Concrete: See Section 033000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 MAINTENANCE

A. Inspect preventive measures as required by the Storm Water Pollution Pervention Plan (SWPPP).
B. Repair deficiencies immediately.
C. Clean out temporary sediment control structures _____ and relocate soil on site.
D. Place sediment in appropriate locations on site; do not remove from site.

3.04 CLEAN UP

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

END OF SECTION

SECTION 015813
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

B. Project informational signs.

1.02 REFERENCE STANDARDS

A. FHWA (SHS) - Standard Highway Signs and Markings; 2004, with Supplement (2012).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Design sign and structure to withstand 50 miles/hr wind velocity.

B. Finishes: Adequate to withstand weathering, fading, and chipping for duration of construction.

2.02 SIGN MATERIALS

A. Structure and Framing: New, wood, structurally adequate.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch thick, standard large sizes to minimize joints.

C. Rough Hardware: Galvanized.

2.03 PROJECT IDENTIFICATION SIGN

A. One sign, 48 sq ft area, bottom 6 feet above ground.

B. Content:
   1. Names and titles of authorities.
   2. Names and titles of Architect and Consultants.
   3. Name of Prime Contractor.

C. Graphic Design, Colors, Style of Lettering: Designated by Architect.

D. Lettering: Standard Alphabet Series C, as specified in FHWA (SHS).

2.04 PROJECT INFORMATIONAL SIGNS

A. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100 foot distance.

PART 3 EXECUTION

3.01 INSTALLATION

A. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

B. Install sign surface plumb and level, with butt joints. Anchor securely.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Sustainable design-related product requirements, including:
   1. Low-emitting products.

C. Re-use of existing products.

D. Transportation, handling, storage, and protection requirements.

E. Product option requirements.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases, and substitution limitations.

B. Section 014000 - Quality Requirements: Product quality monitoring.

C. Section 016116 - Volatile Organic Compound (VOC) Restrictions: Requirements for VOC-restricted product categories.

D. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 DEFINITIONS

A. Basis of Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "Basis of Design Product" including make or model number or other designation. Published attributes and characteristics of basis of design product establish salient characteristics of products.
   1. Evaluation of Comparable Products: In addition to the basis of design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis of design product also establish salient characteristics of products for purposes of evaluating comparable products.

B. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
   1. Identification of basis of design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
   2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

C. Composite Wood and Agrifiber: Products made of wood particles and / or plant material pressed and bonded with adhesive or resin, including:
   1. Particleboard.
   2. Medium density fiberboard (MDF).
   3. Plywood.
   4. Oriented-strand board (OSB).
   5. Wheatboard.
   6. Strawboard.

D. Manufacturer's Inventory of Product Content: Publicly available inventory of every ingredient identified by name and Chemical Abstract Service Registration Number (CAS RN).
   1. For ingredients considered a trade secret or intellectual property, the name and CAS RN may be omitted, provided the ingredient's role, amount, and GreenScreen Benchmark are given.

E. Material Transparency: The practice by manufacturers of disclosing the environmental and health impacts of products.

F. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

G. Reused Products: Reclaimed or salvaged materials and equipment previously used in this or other construction, which extends the lifetime of materials that would otherwise be discarded.
   1. Wood fabricated from timber abandoned in transit after harvesting is considered reused.

1.04 REFERENCE STANDARDS

A. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Sustainable Product Data: Provide sustainable product documentation specified in this Section when required in other Sections, to validate sustainable properties of products.
   1. Documentation must be specific to products actually installed in the Project.

2. Confirm that documentation contains certification labels for the companies and agencies providing certification.

E. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

F. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.06 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.07 PRODUCT WARRANTY REQUIREMENTS

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 3000 - Administrative Requirements.

PART 2 PRODUCTS

2.01 PRODUCTS, GENERAL

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged, and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected", Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

C. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.
   3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

D. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:
   1. No available domestic product complies with the Contract Documents.
   2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.

2.02 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.03 NEW PRODUCTS, GENERAL

A. Provide new products unless specifically required or permitted by Contract Documents.

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

2.04 LOW-EMITTING PRODUCTS

A. Low-Emitting Products: Provide low-VOC-emitting products to meet Owner's sustainability goals for Project and as otherwise required by code.
   1. See Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions, for additional information.

B. VOC Restrictions Data: Provide manufacturer's data that verifies products are at or below acceptable thresholds of volatile content specified in Section 016116.
   1. Items in list below with (CDPH) indicate compliance with California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers" CAL (CDPH SM). See Section 016116 for additional information.

a. Other 3rd party document specifically indicating compliance with standard is acceptable.

2. Examples include, but are not limited to:
   a. Collaborative for High Performance Schools.
      1) Web: https://chps.net/ .
   b. Carpet and Rug Institute (CRI) Green Label Plus (CDPH).
      1) Web: https://carpet-rug.org/testing/green-label-plus/ .
   c. Cradle to Cradle Material Health Certificate.
      1) Web: https://c2ccertified.org/material-health-certificate .
   d. Declare.
      1) Web: https://living-future.org/declare/ .
   e. Emicode (flooring):
      1) Web: https://www.emicode.com/en/home/ .
   f. GreenScreen.
      1) Web: https://www.greenscreenchemicals.org/certified .
   g. Green Squared (tile products).
      1) Web: https://greensquaredcertified.ecomedes.com/ .
   h. Health Product Declaration (HPD).
      1) Web: https://www.hpd-collaborative.org/ .
   i. Intertek, Clean Air Gold certification (CDPH).
      1) Web: https://www.intertek.com/certification/indoor-air-quality/ .
   j. MAS, Certified Green certification (CDPH).
      1) Web: https://mascertifiedgreen.com/ .
   k. SCS Global Services / Resilient Floor Coverings Institute (RFCI), FloorScore (CDPH).
      1) Web: https://www.scsglobalservices.com/services/floorscore .
   l. SCS Global Services, Indoor Advantage.
      1) Web: https://www.scsglobalservices.com/services/indoor-air-quality-certification.
   m. UL Ecologo.
      1) Web: https://www.ul.com/resources/ecologo-certification-program .
   n. UL Greenguard (CDPH - Gold certification required).
      1) Web: https://www.ul.com/services/ul-greenguard-certification .

2.05 PRODUCT OPTIONS

A. Product selection shall be done in accordance with the following requirements:
   1. Standards, Codes and Regulations: Select from among products that are in compliance with the project requirements, as well as with construction standards, all applicable codes and regulations and sustainable design requirements.
   2. Performance Requirements: Provide products that comply with specific performances indicated and are recommended by the manufacturer, in published product literature or by individual certification, for the application indicated.
   3. Prescriptive Requirements: Provide products that have been produced in accordance with prescriptive requirements, using specified ingredients and components and complying with specified requirements for mixing, fabricating, curing, finishing, testing and other operations in the manufacturing process.

B. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

C. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

D. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

E. Basis of Design Products: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers.
   1. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.

F. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

G. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 2500 - Substitution Procedures for proposal of product.

H. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

I. Products, which, by nature of their application, are likely to be needed at a later date for maintenance and repair or replacement work, shall be current models for which replacement parts are available.

2.06 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3000 - Administrative Requirements, for submittal procedures.
   1. Form of Approval of Submittal: As specified in Section 01 3000 - Administrative Requirements.
   2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

2.07 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION, DELIVERY, AND HANDLING REQUIREMENTS

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

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

F. Deliver products in manufacturer's original sealed containers or other packaging system, complete with labels and instructions for handling, storage, unpacking, protection, and installing.
   1. Comply with manufacturer's warranty conditions, if any.

G. Transport and handle products in accordance with manufacturer's instructions.

H. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

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

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

K. Packaging Waste Management: See Section 01 7419 - Construction Waste Management and Disposal.
   1. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION REQUIREMENTS

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.
   1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.
   1. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide off-site storage and protection when site does not permit on-site storage or protection.
   1. Execute a formal supplemental agreement between Owner and Contractor allowing off-site storage, for each occurrence.

I. Protect products in accordance with manufacturers' written instructions.

J. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

K. Comply with manufacturer's warranty conditions, if any.

L. Do not store products directly on the ground.

M. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

N. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

O. Protect liquids from freezing.

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

Q. Prevent contact with material that may cause corrosion, discoloration, or staining.

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

S. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 016116
VOLATILE ORGANIC COMPOUND (VOC) RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products, including:
   1. Adhesives.
   2. Sealants.
   3. Paints and coatings.
   4. Wood.

C. Toxic and hazardous materials to avoid.

D. Toxic and hazardous materials to limit.

E. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures.

1.03 DEFINITIONS

A. Volatile: The tendency of a substance to transition from a solid or liquid state to vapor (evaporate).

B. Volatile Organic Compounds (VOC): Organic compounds that evaporate under normal atmospheric conditions. Some VOCs impact human health and comfort as odor, irritation, chronic toxicity, or carcinogenicity. Materials which produce significantly harmful VOCs are regulated by local, state, and national laws.

C. Ground Level Ozone: A "secondary" pollutant that is produced when nitrogen oxides and VOCs (primary pollutants) react with sunlight and stagnant air. Ozone in the lower atmosphere (ground level to approximately 30,000 feet) is known as ground level ozone. Aerosol sprays contribute to the production of this pollutant.

D. Global Warming Potential: Global warming potential is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide.

E. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings applied on site.
   2. Interior adhesives and sealants applied on site, including flooring adhesives.
   3. Flooring.
   4. Composite wood.
   5. Products making up wall and ceiling assemblies.
   6. Thermal and acoustical insulation.
   7. Free-standing furniture.
   8. Other products when specifically stated in the specifications.

F. Interior of Building: Anywhere inside the exterior weather barrier.

G. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

H. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

I. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
   1. Stone.
   2. Concrete.
   3. Clay brick.
   4. Metals that are plated, anodized, or powder-coated.
   5. Glass.
   6. Ceramics.
   7. Solid wood flooring that is unfinished and untreated.

J. Hazardous Materials: Pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA), the International Agency for Research on Cancer (IARC) or regulated under OSHA Hazard Communication Standard, 29 CFR 1910.1200.

K. Harmful Materials: Materials which contain the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.

L. Composite Wood and Agrifiber: Products such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores that are a composite of wood and / or plant material pressed and adhered together.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).

C. BIFMA e3 - Furniture Sustainability Standard; 2024.

D. BIFMA M7.1 - Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components, and Seating; 2011 (Reaffirmed 2021).

E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers; 2017.

F. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; Current Edition.

G. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.

H. CHPS (HPPD) - High Performance Products Database; Current Edition.

I. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

J. GreenSeal GS-36 - Standard for Adhesives for Commercial Use; 2013, with Editorial Revision (2024).

K. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

L. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

M. SCS (CPD) - SCS Certified Products; Current Edition.

N. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
   1. See Section 01 6000 - Product Requirements, for acceptable documentation.

C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

PART 2 PRODUCTS

2.01 PRODUCT EMISSIONS TESTING AND STANDARDS REQUIREMENTS, GENERAL

A. Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
   1. Wet-Applied Products: State amount applied in mass per surface area.
   2. Paints and Coatings: Test tinted products, not just tinting bases.
   3. Evidence of Compliance: Acceptable types of evidence are the following;
      a. Current UL (GGG) Greenguard Gold certification.
      b. Current SCS (CPD) Floorscore certification.
      c. Current SCS (CPD) Indoor Advantage Gold certification.
      d. Current listing in CHPS (HPPD) as a low-emitting product.
      e. Current CRI (GLP) certification.
      f. Test report showing compliance and stating exposure scenario used.
   4. Product data submittal showing VOC content is NOT acceptable evidence.
   5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
   6. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1 percent weight by mass (total exempt compounds) shall be disclosed.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.
      b. Published product data showing compliance with requirements.
      c. Certification by manufacturer that product complies with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current SCS "No Added Formaldehyde (NAF)" certification.
         1) Web: www.scscertified.com.
      b. Report of laboratory testing performed in accordance with requirements.
      c. Published product data showing compliance with requirements.

D. Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Ceilings, Walls, and Insulation: Ceilings, walls, and thermal insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Furnishings Emissions Standard and Test Method: BIFMA e3 Sections 7.6.1 and 7.6.2, tested in accordance with BIFMA M7.1.
   1. Evidence of Compliance:
      a. Test report showing compliance and stating exposure scenario used.
   2. Any furniture procured as part of this project must meet the Healthier Hospitals Initiative: Healthy Interiors (HHI-Healthy Interiors) standard for 100 percent of furniture, including being free of chemical flame retardants, unless required by code.

2.02 MATERIAL REQUIREMENTS, GENERAL

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
   1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
   2. Furnishings: Comply with Furnishings Emissions Standard and Test Method.
   3. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
   2. Aerosol Adhesives: GreenSeal GS-36.
   3. Joint Sealants: SCAQMD 1168 Rule.
   4. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD 1113 Rule.
      c. CARB (SCM).
   5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

2.03 ADHESIVES

A. The volatile organic compound (VOC) content of all field-applied adhesives, adhesive bonding primers, and adhesive primers used on the interior of this Project to not exceed the limits defined in Rule 1168 - "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California, with a rule amendment date of October 6, 2017.

B. General: For specified building construction related applications, the allowable VOC content is as follows, measured in grams per liter (g/L), less water and less exempt compounds:
   1. Architectural Applications:
      a. Building Envelope Membrane Adhesive: 250.
      b. Carpet pad adhesive: 50.
      c. Ceramic Tile Adhesive: 65.
      d. Cove Base Adhesive: 50.
      e. Gypsum Board and Panel Adhesive: 50.
      f. Multipurpose Construction Adhesive: 70.
      g. Roofing:
         1) Single-Ply Roof Membrane Adhesive: 250.

2) All Other Roof Adhesive: 250.
h. Rubber Floor Adhesive: 60.
i. Structural Glazing Adhesive: 100.
j. Structural Wood Member Adhesive: 140.
k. Subfloor Adhesive: 50.
l. VCT and Asphalt Tile Adhesive: 50.
m. Wood Flooring Adhesive: 100.
n. All Other Indoor Floor Covering Adhesives: 50.
o. All Other Outdoor Floor Covering Adhesives: 50.

2. Specialty Applications:
a. Contact Adhesive: 80.
b. Edge Glue Adhesive: 250.
c. All Other Plastic Cement:
1) ABS Welding: 325.
2) ABS to PVC Transition Cement: 510.
3) PVC Welding: 510.
4) CPVC Welding: 490.
5) All Other Plastic Welding Cements: 250.
d. Adhesive Primer for Plastic: 550.
e. Special Purpose Contact Adhesive: 250.
f. Adhesive Primer for Traffic Marking Tape: 150.
g. Structural Wood Member Adhesive: 140.
h. Top and Trim Adhesive: 250.
i. Plastic Foams: 50.

3. Substrate and Specific Applications:
a. Metal to Metal: 30.
b. Plastic Foams: 50.
c. Porous Material, Except Wood: 50.
d. Wood: 30.
e. Fiberglass: 80.
f. Reinforced Plastic Composite: 250.

4. Other:
a. Other Adhesives: 250.
b. Adhesive Bonding Primers: 250.
c. Adhesive Primers, or Any Other Primers: 250.

5. Adhesive Primers:
a. Plastic: 550.
b. Pressure-Sensitive: 785.
c. Traffic Marking Tape: 150.
d. All Other Adhesive Primers: 250.

2.04 SEALANTS

A. The volatile organic compound (VOC) content of all field-applied adhesives, adhesive bonding primers, sealant primers and sealants used on the interior of this Project to not exceed the limits defined in Rule 1168 - "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California, with a rule amendment date of October 6, 2017.

B. General: For specified building construction related applications, the allowable VOC content is as follows, measured in grams per liter, less water and less exempt compounds:
1. Sealants:

a. Clear, Paintable, and Immediately Water-Resistant Sealant: 280.
b. Foam Insulation and Sealant: 250.
c. Grout Sealant: 65.
d. Non-Staining Plumbing Putty: 150.
e. Potable Water Sealant: 100.
f. Roofing:
    1) Single-Ply Roofing Membrane Sealant: 450.
    2) Other Roofing Sealant: 300.

2. Sealant Primer:
    a. Architectural, Nonporous: 250.
    b. Architectural, Porous: 775.
    c. Modified Bituminous: 500.
    d. Other: 750.

2.05 PAINT AND COATINGS

A. VOC Content Requirements for Wet Applied Products: All paint and coatings wet-applied on site must meet the applicable VOC limits of the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.

B. Product specific requirements are as follows, measured in grams per liter, less water and less exempt compounds:
    1. Paint:
        a. Flat: 50.
        b. Non-Flat: 100.
        c. Non-Flat High-Gloss: 150.
    2. Coatings:
        a. Aluminum Roof Coatings: 400.
        b. Basement Specialty Coatings: 400.
        c. Roofing:
            1) Bituminous Roof Coatings: 50.
            2) Bituminous Roof Primers: 350.
            3) Roof Coatings: 50.
        d. Bond Breakers: 350.
        e. Building Envelope Coatings: 50.
        f. Clear Wood Finish:
            1) Varnish: 275.
            2) Sanding Sealers: 275.
            3) Lacquer: 275.
        g. Concrete Curing Compounds: 100.
        h. Concrete / Masonry Sealers: 100.
        i. Concrete Surface Retarders: 50.
        j. Dry Fog Coatings: 50.
        k. Faux Finishing Coatings:
            1) Clear Topcoat: 100.
            2) Decorative Coatings: 350.
            3) Glazes: 350.
            4) Japan: 50.
        l. Fire-Resistive Coatings: 150.
        m. Floor Coatings: 50.
        n. Form-Release Compounds: 100.
        o. Graphic Arts Coatings / Sign Paints: 200.

p. High-Temperature Coatings: 420.
q. Industrial Maintenance Coatings: 100.
    1) Color-Indicating Safety Coatings: 480.
    2) High-Temperature IM Coatings: 420.
    3) Non-Sacrificial Anti-Graffiti Coatings: 100.
    4) Zinc-Rich IM Primers: 100.
r. Low-Solids Coatings: 120.
s. Magnesite Cement Coatings: 450.
t. Mastic Texture Coatings: 100.
u. Metallic Pigmented Coatings: 150.
v. Multi-Color Coatings: 250.
w. Pre-Treatment Wash Primers: 420.
x. Primers, Sealers, and Undercoaters: 100.
y. Reactive Penetrating Sealers: 350.
z. Recycled Coatings: 250.
aa. Rust-Preventative Coatings: 100.
bb. Sacrificial Anti-Graffiti Coatings: 50.
cc. Shellacs:
    1) Clear: 730.
    2) Opaque: 550.
dd. Specialty Primers, Sealers, and Undercoaters: 50.
ee. Stains: 250.
ff. Stone Consolidants: 450.
gg. Swimming Pool Coatings: 340.
hh. Tile and Stone Sealers: 100.
ii. Traffic Marking Coatings: 100.
jj. Tub and Tile Refinish Coatings: 420.
kk. Waterproofing Membranes: 250.
ll. Waterproofing Sealers: 100.
mm. Waterproofing Concrete / Masonry Sealers: 100.
nn. Wood Coatings: 275.
oo. Wood Preservatives: 350.
pp. Zinc-Rich Primers: 340.

2.06 WOOD

A. Composite Wood: Use no-added-formaldehyde (NAF) or ultra-low-emitting formaldehyde (ULEF) resins.

2.07 TOXIC AND HAZARDOUS MATERIALS TO AVOID

A. Asbestos and Lead, General:
    1. No materials may be used in this project or in any tools, devices, clothing or equipment used to affect this construction that contain asebestos or lead-based paint. All work or materials found to contain asbestos or lead-base paint, or material installed with asbestos containing equipment or lead-base paint will be immediately rejected and this work will be removed by a certified EPA hazard material Contractor under the supervision of a certified hazard material consultant at no additional cost to Owner.
    2. Contractor and subcontractors shall certify that no asbestos containing materials and no lead-base paint were used in this project. Certification letter must be addressed to Owner, including project and Contractors' information; to be notarized.
B. Avoid the use of the following toxic and hazardous materials. Refer to Definitions article above.

1. Asbestos: No products containing asbestos.
2. Lead: Products containing lead content, including older or flux containing not more than 0.25 percent lead in wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures, and 0.20 percent for solder or flux used in plumbing for water intended for human consumption.
3. Mercury:
    a. No new mercury containing thermometers, switches and electrical relays.
    b. All lamps compliant with low-mercury limits.
        1) Illuminated exit signs only use Light-Emitting Diode (LED) or Light-Emitting Capacitor (LEC) lamps.
    c. No mercury vapor or probe-start metal halide high intensity discharge lamps.
4. Added Urea-Formaldehyde: Prefabricated wood products, composite wood, and agrifiber products to contain no added urea-formaldehyde resins.
    a. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.
5. Sealants: Provide products that comply with specified VOC limits. Refer to Section 079200 - Joint Sealants, for additional requirements.
    a. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
6. Avoid the use of the following products: butyl rubber, solvent acrylic, neoprene, styrene butadiene rubber, and nitril.
7. Avoid the use of products containing CFC's or HCFC's.

2.08 TOXIC AND HAZARDOUS MATERIALS TO LIMIT

A. Limit the use of the following toxic and hazardous materials. Refer to Definitions article above.
    1. Halogenated and Organophosphorous Flame Retardants: Limit to 100ppm in the following categories to the extent allowable by local code:
        a. Window and waterproofing membranes, door and window frames and siding.
        b. Flooring, ceiling tiles and wall coverings.
        c. Piping and electrical cables, conduits and junction boxes.
    2. Phthalate (Plasticizers): DEHP, DBP, BBP, DINP, DIDP or DNOP (often found in polyvinyl chloride PVC) are limited in the following components to 0.01 percent (100 ppm):
        a. Flooring, including resilient and hard surface flooring and carpet.
        b. Wall coverings, window blinds and shades, shower curtains, furniture and upholstery.
        c. Plumbing pipes.
        d. Moisture barriers.
    3. Isocyanate-Based Polyurethane: Not to be used in interior finishes.
    4. Urea-Formaldehyde: Limited to 100 ppm in the following components:
        a. Furniture.
        b. Composite wood products.
        c. Laminating adhesives and resins.
        d. Thermal insulation.
    5. Perfluoroalkyl and polyfluoroalkyl substances (such as stain and water repellants).
    6. Antimicrobials.
    7. Fly ash.
    8. Methylene chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, or sealants.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements.

B. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

C. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Pre-installation meetings.
C. Cutting and patching.
D. Surveying for laying out the work.
E. Cleaning and protection.
F. Protection of installed work.
G. Starting of systems and equipment.
H. Final cleaning.
I. Demonstration and instruction of Owner personnel.
J. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
K. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
B. Section 013000 - Administrative Requirements: Submittals procedures, additional meetings not specified here.
C. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
D. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
E. Section 078400 - Firestopping.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
    1. On request, submit documentation verifying accuracy of survey work.
    2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
    3. Submit surveys and survey logs for the project record.
C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
    1. Structural integrity of any element of Project.
    2. Integrity of weather exposed or moisture resistant element.
    3. Efficiency, maintenance, or safety of any operational element.
    4. Visual qualities of sight exposed elements.

5. Work of Owner or separate Contractor.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For surveying work, employ a registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.05 PROJECT CONDITIONS

A. Perform dewatering activities, as required, for the duration of the project.
   1. See Section 015000 - Temporary Facilities and Controls for additional information.

B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
      a. See Section 015000 - Temporary Facilities and Controls for additional information.

D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. See Section 011000 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

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

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations. Furnish information to local uitlity and Owner where necessary to adjust, move, or relocate existing utilities and appertenances.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, and ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

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

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.12 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

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

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Substantial Completion
   1. Prepare and submit a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
      a. Advise Owner of pending insurance changeover requirements.
      b. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
      c. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
      d. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
      e. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
      f. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
      g. Complete startup testing of systems.
      h. Submit test/adjust/balance records.
      i. Complete commissioning requirements.
      j. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

k. Advise Owner of changeover in heat and other utilities.
l. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
m. Complete final cleaning requirements, including touchup painting.

2. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
   a. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
3. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
4. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

C. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

D. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

3.14 **FINAL COMPLETION**

A. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

B. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

C. Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment.
2. Submit copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), certified by the Contractor, stating that each item has been completed or otherwise resolved for acceptance. This inspection list will be reviewed and dated by Architect.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
   a. Submit demonstration and training video recordings.

D. Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will notify Contractor of construction that must be completed or corrected.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Following completion of all final inspection items, Contactor shall prepare and submit a final Certificate for Payment.
3. Owner may proceed with preparation of Notice of Final Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 017419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for management and disposal of construction waste, including waste management plan.

1.02 WASTE MANAGEMENT REQUIREMENTS

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
   1. Provide containers with lids. Remove trash from site periodically.
   2. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

B. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

C. Owner requires that this project generate the least amount of trash and waste possible.
   1. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
   2. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood.
   5. Land clearing debris, including brush, branches, logs, and stumps.
   6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
   7. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   8. Glass.
   9. Gypsum drywall and plaster.
   10. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
   11. Paint.
   12. Plastic sheeting.
   13. Rigid foam insulation.

E. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.

F. Develop and follow a Waste Management Plan designed to implement these requirements.

G. The following sources may be useful in developing the Waste Management Plan:

H. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.03 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures.

B. Section 013000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

D. Section 016000 - Product Requirements: Waste prevention requirements related to product substitutions.

E. Section 016000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

F. Section 017000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.04 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Waste management plan.

C. Waste disposal records.

1.06 WASTE MANAGEMENT PLAN

A. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

B. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
   2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
   3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
   4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

1.07 WASTE DISPOSAL REPORTS

A. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.

d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

4. Incinerator Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
   c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
5. Recycled and Salvaged Materials: Include the following information for each:
   a. Identification of material, including those retrieved by installer for use on other projects.
   b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
   c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards.
   c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

B. Recycling Incentive Programs:
   1. Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.
   2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 016000 and Section 012500.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 016000:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal requirements.

B. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

C. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

D. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   3. Field changes of dimension and detail.
   4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide control diagrams by controls manufacturer as installed.

J. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

K. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

L. Include test and balancing reports.

M. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 017800.01

WARRANTY/GUARANTEE FORM – NOTICE OF COMPLETION

FOR _____ WORK

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

Project Name: (Insert Project Name)

Owner: (Insert Owner's Name)

Location: (Insert Project Location)

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

(Insert Written Years) (Insert Arabic Numeral of Years) Years(s)

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

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

Date: _____

(Insert Name of Contractor)	(Insert Name of Subcontractor, Sub-Subcontractor, Manufacturer or Supplier)
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____
State License No: _____	State License No: _____

Local Representative: For Maintenance, Repair, or Replacement Service, Contact:

Name: _____

Address: _____

Phone Number: _____

SECTION 017800.02

WARRANTY/GUARANTEE FORM – SUBSTANTIAL COMPLETION

FOR_____ WORK

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

Project Name: (Insert Project Name)

Owner: (Insert Owner's Name)

Location: (Insert Project Location)

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

(Insert Written Years) (Insert Arabic Numeral of Years) Years(s)

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

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

Date:_____

(Insert Name of Contractor)

Signature: _____

Name:_____

Title:_____

State License No:_____

(Insert Name of Subcontractor, Sub-Subcontractor, Manufacturer or Supplier)

Signature: _____

Name: _____

Title: _____

State License No: _____

Local Representative: For Maintenance, Repair, or Replacement Service, Contact:

Name: _____

Address: _____

Phone Number: _____

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. Plumbing equipment.
   3. Electrical systems and equipment.
   4. Landscape irrigation.
   5. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit not less than four weeks prior to start of training.
   2. Revise and resubmit until acceptable.
   3. Provide an overall schedule showing all training sessions.
   4. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

D. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

E. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.03 DEFINITIONS

A. Demolish: Dismantle, raze, destroy, or wreck any building or structure or any part thereof.

B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.

C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.

D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Indicate:
   1. Vegetation to be protected.
   2. Areas for temporary construction and field offices.

3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
   1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
   2. Summary of safety procedures.
   3. Demolition firm qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

A. Remove paving and curbs required to accomplish new work.

B. Remove portions of concrete slabs on grade as indicated on drawings.

C. Remove other items indicated, for salvage, relocation, and recycling.

D. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with requirements in Section 01 7000 - Execution and Closeout Requirements.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
   6. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
   7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Protect existing structures and other elements to remain in place and not removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
   1. Verify construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

C. Remove existing work as indicated and required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
   2. Remove items indicated on drawings.

D. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
   1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
   1. Prevent movement of structure. Provide shoring and bracing as required.
   2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch to match new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Comply with Section 01 7419 - Construction Waste Management and Disposal.

B. Remove debris, junk, and trash from site.
C. Remove materials not to be reused on site.
D. Leave site in clean condition, ready for subsequent work.
E. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 031000
CONCRETE FORMING AND ACCESSORIES

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.

1.02 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 051200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

A. The applicable version of the standards listed below shall be per Chapter 35 of Part 2 of the 2022 edition of the California Building Code (CBC), including addendums and errata. Where the standard is not listed, then the most current version of the standard shall be used or as referenced by other standards.

1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 303R – Guide to Cast-in-Place Architectural Concrete for Buildings.
4. ACI 318 - Building Code Requirements for Structural Concrete.
5. ACI 347R - Guide to Formwork for Concrete.
6. ASME A17.1 - Safety Code for Elevators and Escalators.
7. ASTM D1621 – Test Method for Compressive Properties of Rigid Cellular Plastics.
8. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics
9. ASTM D6817/D6817M – Standard Specification for Rigid Cellular Polystyrene Geofoam
10. U.S. Department of Commerce Product Standard:
    a. PS 1 - Structural Plywood.
11. West Coast Lumber Inspection Bureau (WCLIB):
    a. Grading and Dressing Rules No. 17
12. United States Green Building Council (USGBC):
    a. Leadership in Energy and Environmental Design (LEED):
    b. Green Building Rating System.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials and installation requirements.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1. Indicate location of form ties on exposed concrete walls.
2. Include locations and placement of steel embeds.
3. Indicate proposed locations of constructions joint.

D. Shoring and Reshoring:
1. Submit for records proposed design of shoring, schedule and sequencing of shoring installation and removal, and installing and removing reshoring.

E. Designer's Qualification Statement.

F. Design Data: As required by authorities having jurisdiction.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design formwork under direct supervision of a Professional Civil or Structural Engineer experienced in design of concrete formwork and licensed in the State in which the Project is located.

B. Neither the Architect nor the Architect's consultants have been retained to design formwork, nor to determine the means and methods by which such operations are accomplished.

C. Prior to erecting formwork, coordinate locations of plumbing, mechanical, and electrical blockouts in concrete slabs.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

C. Protect plastic foam products from damage and exposure to sunlight.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete forms that complies with design with respect to shape, lines, and dimensions.

C. Limit deflections to 1/8" between supports after placement of concrete.

D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

E. Formwork design shall comply with ACI 347R, ACI 301, and ACI 318.
1. Design shall be based on calculations prepared by a licensed engineer in the State in which the Project is located.

F. Erect formwork in a manner that will ensure the safety of construction personnel and the public.

2.02 WOOD FORM MATERIALS

A. Plywood: PS 1, Grade B-B, Class I.
1. Douglas Fir species; solid one side grade; sound undamaged sheets with clean, true edges.

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

2.03 METAL FORM MATERIALS

A. Metal: Min 16 ga sheet steel, tight fiitting, and stiffened to support weight of concrete such that tolerances are maintained.

B. Metal Deck Forms: Metal deck as specified in Contract Drawings.

2.04 FORMWORK ACCESSORIES

A. Form Ties: Removable or snap-off type, galvanized metal or glass-fiber-reinforced plastic, fixed length, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.
   1. Ties should leave no corrodible metal closer than 1 inch to exposed concrete surface.
   2. Ties shall be designed to resist lateral pressure of concrete on forms and prevent spalling of concrete on removal.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
   1. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable-oil based compound.
   2. VOC Content: In compliance with applicable local, State, and federal regulations.
   3. Products:
      a. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com/#sle.
      b. W. R. Meadows, Inc; Duogard: www.wrmeadows.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.

D. Filler Strips for Chamfered Corners: Rigid plastic or wood type; size per contract drawings; maximum possible lengths.

E. Flashing Reglets: Galvanized steel, at least 22 gage, 0.0299 inch thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

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

G. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 051200.

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. Earth Forms may be used if compacted fill or natural soil can be accurately cut and maintained.

B. 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 301.

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

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

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

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Coordinate this section with other sections of work that require attachment of components to formwork.

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

3.04 APPLICATION - FORM RELEASE AGENT

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

B. Apply non-staining, rust-preventative form oil or other means of protection against rusting to steel forms.
   1. Rust-stained steel formwork is not acceptable for use.

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

D. 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 passing through concrete work.

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

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

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

E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.

F. 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.

G. 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 forms as erection proceeds, to remove foreign matter within forms.

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

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

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

C. Do not reuse formwork without Architect's approval. When approved, do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.
   1. Reused formwork shall meet appearance requirements of new formwork.
   2. Reused formwork shall be free of splaying, fraying, delamination or other damage.
   3. Follow all requirements as for new formwork.

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.

B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after curing at not less than 50 degrees F for 72 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed until concrete has attained 28-day minimum design compressive strength, but in no case less than 21 days for standard reinforced concrete and 7 days for post-tensioned concrete. Determine potential compressive strength of in- place concrete by testing representative field-cured concrete specimens of concrete in question.

D. Form facing material may be removed 7 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

E. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

F. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

G. If accelerated form removal is desired, submit methods to Architect for review. Review by Architect does not alleviate contractor of responsibility for means and methods of construction and protection of structure during construction.

H. Reshore members as required in section below.

3.10 RESHORING

A. Shoring and reshoring shall conform to the requirements of ACI 347.

B. Extend shoring and reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete.

C. Plan and sequence removal of shores and reshore to avoid damage to concrete. Provide adequate reshoring to support construction without excessive stress or deflection.

D. Shores shall not be removed prior to concrete achieving 28 day strengths.

E. While reshoring operations are under way, no construction ldoads shall be permitted on the new construction.

END OF SECTION

SECTION 032000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.
B. Supports and accessories for steel reinforcement.
C. Reinforcing steel for masonry work.

1.02 RELATED REQUIREMENTS

A. Section 014113.11 - Regulatory Requirements - Global Warming Potential (GWP)
B. Section 031000 - Concrete Forming and Accessories.
C. Section 033000 - Cast-in-Place Concrete.
D. Section 042000 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

A. The applicable version of the standards listed below shall be per Chapter 35 of Part 2 of the 2022 edition of the California Building Code (CBC), including addendums and errata. Where the standard is not listed, then the most current version of the standard shall be used or as referenced by other standards.
   1. ACI 301 - Specifications for Concrete Construction.
   2. ACI 315 – Details and Detailing of Concrete Reinforcement.
   3. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
   4. ACI MNL-66 - ACI Detailing Manual.
   5. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
   6. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   7. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
   8. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
   9. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   10. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination
   11. AWS A5.1 – Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
   12. AWS A5.5 – Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
   13. AWS D1.1/D1.1M – Structural Welding Code – Steel.
   14. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.
   15. AWS D1.8/D1.8M - Structural Welding Code - Seismic Supplement.
   16. CRSI (DA4) - Manual of Standard Practice.
   17. CRSI (P1) - Placing Reinforcing Bars.
B. California Code of Regulations (CCR):
   1. CBSC, Title 24, Part 2- California Building Code (CBC), 2022 edition.

a. Chapter 17 - Structural Tests and Inspections
b. Chapter 19 - Concrete
2. CBSC, Title 24, Part 11 - California Green Building Standards Code (CALGreen)
a. Supplement 1, July 2024

C. US Army Corps of Engineers (USACE)
1. CW03210: Civil Works Construction Guide Specifications for Steel Bars, Welded Wire Fabric and Accessories for Concrete Reinforcement

D. United States Green Building Council (USGBC):
1. Leadership in Energy and Environmental Design (LEED):
2. Green Building Rating System.

1.04 GENERAL

A. Coordination: Refer to Section 017419 - Construction Waste Management and Disposal regarding procedures for implementing construction waste management requirements.

B. Coordination: Coordinate Work specified in this Section with other Sections which require placement of embedded products and provision of openings and recesses. If formwork is placed after reinforcing, resulting in insufficient concrete cover over reinforcing, request instructions from Architect (Structural Engineer) before proceeding.

C. Refer to Section 013000 - Administrative Requirements for RFI requirements.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Reinforcing Shop Drawings:
1. Prepare Shop Drawings in accordance with the applicable requirements of ACI 318 and the CRSI Manual.
2. Provided scaled, dimensioned reinforcing plans for each floor level indicating size and spacing of reinforcing. Coordinate additional bars with locations of slab openings, penetrations, depressions and steps. Shop drawing shall be coordinated with concrete shop drawings. Ensure penetrations from affected trades for utilites are coordinated.
3. Provide scaled, dimensioned reinforcing elevations for each wall line indicating size and spacing of reinforcing. Coordinate additional bars with locations of openings, penetrations, and recesses. Shop drawing shall be coordinated with concrete shop drawings. Ensure penetrations from affected trades for utilites are coordinated.
4. Indicate welds in accordance with AWS D1.4/D1.4M and AWS A2.4.
5. Indicate type of corrosion resistant reinforcing proposed and locations, if applicable.
6. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

C. Test Reports: Submit certified laboratory test reports confirming physical characteristics of materials used in the performance of the work of this Section.
1. Where reinforcing is subject to welding, submit carbon equivalent determination reports in accordance with requirements of Source Quality Control.

D. Certificates: Submit copies of steel producer's certificates of mill analysis, tensile, and bend tests for reinforcing steel. Transmit copy to installer for welded splices.

E. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

F. Sustainable Design Submittals:
1. Type III factory-specific or product-specific environmental product declarations (EPD) for each grade of reinforcement proposed for the project.

2. Materials & Resources Submittals: Refer to Section 018113 for additional information on LEED Submittals.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 318, ACI 301, CRSI and CBC Chapter 19.

B. Fabricator's Qualifications:
   1. When required, show evidence of approval by governmental agencies having jurisdiction.

C. Welding of reinforcing shall be in conformance with AWS D1.1/D1.1M, AWS D1.4/D1.4M, AWS D1.8/D1.8M, and CBC Chapter 19.

D. Qualification of Welds, Welding operators, and welders:
   1. Comply with applicable building code standard. Perform welding procedure qualification, except for prequalified procedures, as required by AWS D1.4/D1.4M, prior to executing any welding of reinforcing steel.
   2. Only AWS Certified Welding Inspectors shall be used for tests and qualifications associated with welding of reinforcing steel.
   3. Only AWS qualified welders or welding operators shall perform welding of reinfocing steel.
   4. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months and in accordance with AWS D1.4/D1.4M.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage. Deliver reinforcing materials bundled and with identifying labels or tags affixed and legible.
   1. Bundle reinforcing, tag with identification, and transport and store so as not to damage any material. Use metal tags indicating size, length and other marking shown on placement drawings. Maintain tags after bundles are broken.

B. The Inspector and/or Architect reserves the right to observe deliveries, to review bills of lading, and to reject the following:
   1. Reinforcing not accompanied by required mill certificates.
   2. Reinforcing exhibiting rusting or other contamination which might prohibit or inhibit bonding of concrete.

C. Store materials off ground and under cover.
   1. Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening contaminants.
   2. Store welding electrodes in accordance with AWS standards.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Provide deformed-type reinforcing conforming to ASTM Standards and material Grades as noted on Structural Contract Drawings.
   1. When welding is indicated, provide reinforcing conforming to the requirements of ASTM A 706, Grade 60.

B. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. WWR Style: As indicated on drawings.

C. Global Warming Potential (GWP) Limit: as indicated on the drawings.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch, conforming to ASTM A1064/A1064M , Grade 60.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Provide stainless steel components for placement within 1-1/2 inches of weathering surfaces.

2.02 MECHANICAL REBAR SPLICING:

A. Coupler Systems: For use where indicated on drawings, mechanical devices for splicing reinforcing bars; designed to develop minimum 1.25Fy or Fu of the reinforcing bars in both tension and compression, conforming to ACI 318 Type II coupler. Splicing system shall be listed by the International Code Council (ICC) or by the International Association of Plumbing and Mechanical Officials Evaluation Service (IAPMO-ES)
   1. Mechanically Locked Sleeves: Steel sleeves with internal gripping rails and external shear bolts, designed to positively engage the unaltered ends of butted reinforcing bars.
      a. Products: Dayton Superior “Bar-Lock" System.
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Dowel Bar Splicers: Integral forged bar end, female-threaded, with nailing flange on one bar and integral matching male threads on the other bar. Provide specially forged bar ends, such that the cut male threads do not diminish the original bar cross section dimension.
      a. Products: Dayton Superior; "DBDI" System.
      b. Substitutions: See Section 016000 - Product Requirements.

2.03 FABRICATION

A. Do not fabricate reinforcing until shop drawings have been reviewed by LPA.

B. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice, ACI MNL-66: Detailing Manual, and ACI 318.

C. In case of fabrication errors, do not rebend or straighten reinforcing in a manner that will injure or weaken the material.

D. Do not heat reinforcing to faciliate bending.

E. Welding of reinforcement is permitted only where shown on drawings using ASTM A706 reinforcing. Perform welding in accordance with AWS D1.4/D1.4M.
   1. Protect joints from drafts during cooling process. Accelerated cooling is prohibited.
   2. Do not tack weld reinforcing.
   3. See structural general notes for requirments for fusion welding.

F. Locate reinforcing splices not indicated on drawings at point of minimum stress.

G. Comply with tolerances per ACI 117 and CRSI Manual.

H. Reinforcing with any of the following defects will not be permitted:
   1. Lengths, depths, and bends not conforming to the spcified fabrication tolerances.
   2. Bends or kinks not indicated in the drawings.
   3. Reinforcing with reduced cross-section due to excessive rusting or other causes.

2.04 SOURCE QUALITY CONTROL

A. Tests: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry recognized procedures.

B. Reinforcing to be welded:
   1. Submit a copy of the mill test report to the Architect prior to placement of reinforcing steel in concrete members.
   2. If mill test reports are not available, perform a chemical analysis of reinforcing representative of the reinforcing to be welded. The carbon equivalent (CE) shall not exceed 0.55.
   3. Special inspection is required for welding of steel reinforcing.

C. Source Quality Control: Testing Laboratory shall test samples of reinforcing, ties, and stirrups from the material at the site or from place of distribution. Each sampling shall include at least two 18-inch long pieces. Perform the following tests according to ASTM A615:
   1. Identified Reinforcing: Samples shall be obtained from bundles delivered from the mill, identified by heat number and accompanied by mill analyses and mill test reports. Reinforcing shall be properly tagged with Identification Certificate so as to be readily identified. Then perform one tensile and one bend test for each 10 tons or fraction thereof of each size of reinforcing per CBC Section 1909.2.4. Submit mill reports when samples are selected.
   2. Unidentified reinforcing is not permitted.
   3. Refer to Section 014000 - Quality Requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean reinforcing to remove loose rust and mill scale, earth, and other materials which might reduce or destroy bond with concrete.

3.02 PLACEMENT

A. General: Comply with the CRSI Manual of Standard Practice and CRSI Placing Reinforcing Bars, 10th edition, for details and methods of placing reinforcing and supports.
   1. Do not displace or damage vapor barrier while placing concrete reinforcing. If damage occurs, repair vapor barrier before placing concrete.
      a. Provide for movement which equals joint width plus 1/2-inch.
   2. Expansion Joints in Slab-on-grade: Interrupt reinforcing at expansion joints. Provide No. 5 by 24-inch long dowelled joints at 18 inches on centers with one end of dowel set in capped dowel sleeve.
   3. Construction Joints: Allow reinforcing to run through without interruption, unless otherwise noted on Contract Structural Drawings.

B. Support: Position, support, and secure reinforcing against displacement by formwork, construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers as required and as indicated on Contract Drawings.
   1. Provide sufficient numbers and sizes of supports to carry reinforcing.
      a. Do not place reinforcing more than 2 inches beyond the last leg of any continuous reinforcing support.
      b. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
      c. Provide additional reinforcing for support where required to support reinforcing shown on Contract Drawings.
   2. Repair and resupport reinforcing which may have moved during concrete placement operations.

C. Securing in Place:

1. Accurately place reinforcing and wire tie in precise position where reinforcing cross. Bend ends of wire ties away from the forms. Wire tie reinforcing to corners of ties and stirrups.
2. Support reinforcing according to the current edition of CSRI Recommended Practice for Placing Reinforcing Supports using approved accessories and chairs.
3. Place precast concrete cubes with embedded wire ties to support reinforcing steel in concrete placed on grade and in footings. Precast concrete cubes are not acceptable in elevated concrete slabs, beams, or concrete filled metal deck.
4. Use care not to damage vapor barriers where they occur.
5. Dowel Bar Couplers:
    a. Attach flanged, internally threaded end of dowel bar coupler to inside of formwork, using nails or screws.

D. Coverage: Place reinforcing to obtain minimum coverages for concrete protection in accordance with ACI 318 Chapter 20.5.1.3, or as indicated on Contract Structural Drawings. Securely tie reinforcing and related supports together with tie wire to hold reinforcing accurately in position during concrete placement operations. Place wire ties so that twisted ends are directly away from exposed concrete surfaces.

E. Clearance Between Reinforcing: Per ACI 318 and as indicated on Contract Drawings.

F. Splicing:
1. Provide standard reinforcing splices by lapping ends and tying securely with tie wire. Comply with details indicated on Contract Structural Drawings.
    a. Unless noted otherwise on Contract Drawings, comply with requirements of ACI 318 for minimum lap of Class B spliced reinforcing, including ACI 318 as amended by CBC.
2. Provide 1-1/2-inch minimum clearance between sets of splices. Stagger horizontal reinforcing so that adjacent splices are greater than 4 feet apart, unless noted otherwise on Structural Contract Drawings.
3. Field Welding: Comply with the requirements of AWS D1.4 where field welding is required. Prior to field welding, determine the weldability of reinforcing in accordance with section "Source Quality Control" in Part 2. Only steel conforming to the chemical requirements of AWS D1.4 may be welded.
4. Splices: Do not splice reinforcing at the points of maximum stress except where indicated. Lap splices as shown or required to develop the full strength of reinforcing. Stagger splices in horizontal wall reinforcing at least 24" longitudinally in alternate reinforcing and opposite faces.
5. Mechanical Couplers:
    a. Mechanically Locked Sleeves:
        1) During installation, ensure no damage or misalignment occurs to gripping rails; discard sleeve if damage occurs.
        2) Insert first reinforcing bar completely, until it contacts internal divider.
        3) Holding bar in position, hand-tighten all bolts.
        4) Repeat above procedure for second bar.
        5) In random, alternating order, tighten all bolts to 50% of the specified torque.
        6) In random, alternating order, tighten all bolts to 75% of the specified torque
        7) In random, alternating order, drive each bolt until head shears off.
    b. Dowel Bar Couplers:
        1) Splice open end of dowel bar to internal reinforcing steel.
        2) After concrete has set up, thread externally threaded dowel bar into internally threaded dowel bar; hand tighten.
        3) Then, attempt to rotate coupler further 1/4 turn by hand-tightening.
        4) Splice open end of dowel bar to internal reinforcing steel.

G. Wire Fabric: Install welded wire fabric in longest lengths practicable. Lap adjoining pieces at least 12 inches minimum, and lace splices with tie wire. Offset end laps in adjacent widths to prevent continuous laps.
   1. Extend fabric to within 1 inch of edge at slabs.

H. Slab on Grade Reinforcing: Do not displace or damage vapor retarder at slab on grade.

I. Dowels: Secure tie dowels in place before depositing concrete. Provide No. 3 reinforcing for securing dowels where no other reinforcing is provided

J. Maintaining Reinforcing in Position: Provide adequate means to ensure that reinforcing position and spacing is maintained during placement of concrete.

K. Adjustment and Inspection: Do not bend or straighten reinforcing in a manner injurious to material. Do not use reinforcing with kinks or bends not shown on Drawings and reviewed shop drawings or reinforcing with reduced cross-section due to corrosion or other cause.

L. Tolerances: Placement tolerances shall conform to CRSI Manual of Standard Practice and ACI 117.

3.03 MASONRY REINFORCING

A. Refer to section 042000 - Unit Masonry for installation of masonry reinforcing.

B. Splice reinforcing in masonry with laps as indicated on Contract Drawings.

C. Position vertical reinforcing in masonry walls and tie in position top and bottom, and at intervals not exceeding 192 bar diameters, unless noted otherwise on the Contract Drawings.

D. Provide dowels between footings and walls of the same grade, size, and spacing as vertical wall reinforcing, unless noted otherwise on the Contract Drawings.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 014000 - Quality Requirements, will inspect installed reinforcement for conformance to contract documents before concrete placement.

B. Inspection and Tests of Welds: Provide special inspection of shop and field welding in accordance with CBC Section 1704, 1705, 1903, and Structural Contract Drawings.
   1. Tests will be made by testing laboratory for reinforcing welds, as follows:
      a. Qualification of welders engaged in electric-arc welding of reinforcing.
      b. Verification of location of reinforcing for accuracy.
      c. Inspection of reinforcing welds by certified welding inspectors.
      d. X-ray test of one of the first three arc-welds made by each welder.
   2. Tensile tests of sample welds of the largest size reinforcing for each type of welding.
   3. When welds are judged to be deficient, provide and pay for such additional X-rays and tests as directed by the Architect. Defective welds shall be repaired, replaced, and retested.

C. Placing: Provide special inspection as required by CBC 1705.
   1. Placement of Grade 60 or higher reinforcing steel for concrete above grade requires special inspection.
   2. Schedule inspecting of reinforcing steel for conduit, sleeves, and embedded items to allow for correction, if necessary, before placement of overlying grids on reinforcing steel.

3.05 ADJUSTING

A. Defective Reinforcing Work: The following shall be considered defective and may be ordered removed and reconstructed at no change in Contract Time or Contract Sum:
   1. Reinforcing with kinks or bends not shown on Contract Drawings.

2. Reinforcing injured due to bending or straightening.
3. Reinforcing heated or bent.
4. Reinforcing not placed in accordance with Contract Documents.
5. Reinforcing that is rusty or oily.
6. Reinforcing exposed in surface of concrete

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete building frame members.
B. Elevated concrete slabs.
C. Floors and slabs on grade.
D. Concrete shear walls, elevator shaft walls, and foundation walls.
E. Concrete foundations.
F. Joint devices associated with concrete work.
G. Site Concrete Elements, including, but not limited to freestanding walls and their foundations, retaining walls and their foundations, light pole bases and their foundations, and flagpole bases and their foundations.
H. Miscellaneous concrete elements, including equipment pads and equipment pits.
I. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 014113.11 - Regulatory Requirements - Global Warming Potential (GWP)
B. Section 031000 - Concrete Forming and Accessories: Forms and accessories for formwork.
C. Section 032000 - Concrete Reinforcing.
D. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
E. Section 323353 - Architectural Site Concrete for additional requirements for retaining walls and other site concrete.

1.03 REFERENCE STANDARDS

A. The applicable version of the standards listed below shall be per Chapter 35 of Part 2 of the 2022 edition of the California Building Code (CBC), including addendums and errata. Where the standard is not listed, then the most current version of the standard shall be used or as referenced by other standards.
    1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
    2. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide.
    3. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
    4. ACI 232.2R – Report on the Use of Fly Ash in Concrete
    5. ACI 233R – Guide to the Use of Slag Cement in Concrete
    6. ACI 234R – Guide for the Use of Silica Fume in Concrete
    7. ACI 301 - Specifications for Concrete Construction.
    8. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
    9. ACI 303R – Guide to Cast-in-Place Architectural Concrete Practice
    10. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
    11. ACI 305R - Guide to Hot Weather Concreting.

12. ACI 306R - Guide to Cold Weather Concreting.
13. ACI 308R - Guide to External Curing of Concrete.
14. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
15. ACI 347R - Guide to Formwork for Concrete.
16. ACI 360R – Guide to Design of Slabs-on-Ground
17. ACI 503.4 – Standard Specification for Repairing Concrete with Epoxy Mortars
18. ACI MNL-15 – Field Reference Manual
19. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
20. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
21. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
22. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
23. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
24. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens).
25. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
26. ASTM C150/C150M - Standard Specification for Portland Cement.
27. ASTM C157/C157M - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
28. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
29. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete.
30. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
31. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
32. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
33. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
34. ASTM C295/C295M - Standard Guide for Petrographic Examination of Aggregates for Concrete.
35. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
36. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete.
37. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
38. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
39. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements.
40. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
41. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
42. ASTM C755 - Standard Practice for Selection of Water Vapor Retarders for Thermal Insulation.
43. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
44. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars.
45. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

46. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
47. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
48. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
49. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
50. ASTM D1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
51. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
52. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
53. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
54. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
55. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
56. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
57. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
58. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
59. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
60. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

B. California Code of Regulations (CCR):
   1. CBSC, Title 24, Part 2- California Building Code (CBC), 2022 edition.
      a. Chapter 11b - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing:
         1) Division 3 - Building Blocks.
            (a) Section 11B-302 - Floor or Ground Surfaces.
         2) Division 4 - Accessible Routes.
            (a) Section 11B-403 - Walking Surfaces.
      b. Chapter 17 - Structural Tests and Inspections.
      c. Chapter 19 - Concrete.
   2. CBSC, Title 24, Part 11 - California Green Building Standards Code (CALGreen), 2022 edition.
      a. Supplement 1, July 2024

C. US Army Corps of Engineers (USACE)
   1. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops 1974.

D. ICC Evaluation Service, Inc. (ICC ES), a subsidiary corporation of the International Code Council:
   1. ICC ES Evaluation Reports (ESR) for Materials, Products, Methods, and Types of Construction with current report conforming to the applicable building code.

E. International Association of Plumbing and Mechanical Officials (IAPMO):
   1. IAPMO Uniform Evaluation Service (UES) Report for Materials, Products, Methods, and Types of Construction with current report conforming to the applicable building code.

F. Public Works Standards, Inc. (PWS):

1. Standard Specifications for Public Works Construction, (Greenbook), latest edition with amendments, published by BNi Building News.

G. United States Green Building Council (USGBC):
1. Leadership in Energy and Environmental Design (LEED):
2. Green Building Rating System.

1.04 GENERAL

A. Identify finish flooring manufacturers' concrete slab vapor emission and alkalinity requirements and coordinate concrete slab mixing and installation procedures to achieve desired results. Concrete slab requirements for finish flooring may be more restrictive than general requirements of the Contract Documents, and may require additional materials, means, or methods. Additional materials, means, or methods shall be included as part of the work.

B. Coordinate method of securing reinforcing and other embedded items in concrete slabs on grade without penetrating vapor barriers.

C. Verify depth of slab depressions for waterproofing and toppings at walking decks.

D. Verify depth of slab depression for frame and pan of entrance floor grilles. Coordinate leveling of floor with floor leveling compound and embedment of frame.

1.05 DEFINITIONS

A. Embodied Carbon Footprint: Embodied carbon is the carbon dioxide equivalent (CO2e) footprint of the Project before it becomes operational. Embodied carbon is expressed as Global Warming Potential (GWP).

B. Global Warming Potential: Global Warming Potential (GWP) is the heat absorbed by any greenhouse gas in the atmosphere as a multiple of the heat that would be absorbed by the same mass of carbon dioxide. GWP is 1 for CO2. GWP for reinforcing is expressed as kg of CO2e per metric ton of fabricated steel reinforcing.

C. Environmental Product Declaration: An Environmental Product Declaration (EPD) quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function. EPDs are conducted in accordance with a Product Category Rule for the specific product being evaluated.

D. Product Category Rule: Product Category Rules (PCR) are a set of rules, requirements, and guidelines for developing Environmental Product Declarations (EPD) for one or more categories.

E. Life Cycle Assessment: Life Cycle Assessment (LCA) is a methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions, along with agency approvals (ICC, IAPMO, etc.) where applicable.

C. Mix Design: Submit proposed concrete mix design for approval.
1. Submit design mix data for each type of concrete and each compressive strength required on the Contract Drawings. Submittal of mix designs shall not relieve Contractor of its responsibility to furnish concrete of proper consistency and specified strengths. Where used for concrete subject to special inspections, submit mix designs to testing laboratory for review and written acceptance.

a. Indicate proposed mix design complies with requirements of ACI 301, Section 4 and ACI 318 26.4.3.
b. Design mix submittal shall be stamped and signed by a professional engineer licensed in the State of California.
c. For each material, including admixtures and water, state water-cement ratio and maximum allowable water content.
d. For each material, state manufacturer's name, designation, and source.
e. Submit shrinkage and creep factors for each type of aggregate, and each source proposed for use, for acceptance-review.
f. For each mix design:
    1) Pay costs associated with mix design preparation.
    2) Consider concrete cover and clear distances between reinforcing bars as indicated on the Contract Drawings in determining the aggregate size for mix designs. This may result in an aggregate size smaller than specified elsewhere in this Specification.
    3) Submit a schedule which identifies the locations within the structure where each mix design is proposed for use.
    4) Submit project specific 28-day shrinkage test results in accordance with shrinkage test requirements in Part 2 "CONCRETE MIX DESIGN."
    5) Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.

D. Shop Drawings. Concrete shop drawings shall be coordinated with shop drawings requirements for reinforcement and formwork. Submit the following items for review:
1. Layout drawings showing locations of slab-on-grade joints.
2. Scaled, dimensioned plans for each floor level indicating size and location of slab openings, penetrations, depressions, and steps. Shop drawing shall be coordinated with reinforcing shop drawings. Ensure penetrations from affected trades for utilities are coordinated.
    a. Provided review stamp, with signature and date, of each trade proposed to work within the opening or penetration.
3. Proposed Construction Joints.
4. Scaled, dimensioned concrete elevations for each wall line indicating size and location of openings, penetrations, and recesses. Shop drawing shall be coordinated with reinforcing shop drawings. Ensure penetrations from affected trades for utilities are coordinated.
    a. Provided review stamp, with signature and date, of each trade proposed to work within the opening or penetration.

E. Concrete Placement Schedule: Submit the proposed concrete placement schedule to the Architect for review prior to start of concrete placement.

F. Samples:
1. Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.
2. Submit samples of underslab vapor retarder to be used.
3. Submit two, 12 inch long samples of waterstops and construction joint devices.
4. Aggregate proposed for exposed finish, indicating color, texture, and size, for acceptance-review. Submit not less than 1 pound of aggregate.

G. Test Reports: Submit report for each test or series of tests specified.
1. Submit certified laboratory test reports to Architect and, when applicable, the authority having jurisdiction, confirming physical characteristics of materials used.
2. Shrinkage and petrographic tests on concrete with the proposed aggregate.

H. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.

2. Aggregates and sand.
3. Admixtures.
4. Fiber reinforcement.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semi-rigid joint filler.
11. Joint-filler strips.
12. Repair materials.

I. Sustainable Design Submittals:
   1. Embodied Carbon Footprint Submittals
      a. Plant-specific Environmental Product Declaration (EPD) for each concrete mixture proposed for the project accompanying each concrete mixture submittal.
      b. A calculation showing that the Global Warming Potential (GWP) of all the concrete supplied for the project shall be lower than the GWP target set in Section 2.
   2. Materials & Resources Submittals: Refer to Section 018113 for additional information on LEED submittals.
   3. Indoor Environmental Quality Submittals: Refer to Section 018113 for additional information on LEED submittals.

J. Project Record Documents:
   1. Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
   2. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
   3. Concrete Placement: Date and time of each placement as provided in the placement schedule. Include start and end times, temperatures, humidities, and wind velocities.
   4. Test Cylinders: Cross-reference to placement record entries

1.07 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with ICC (IBC) Chapter 19.
   1. Chemical products field-applied to concrete shall comply with the air quality requirements of authorities having jurisdiction.

B. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Follow recommendations of ACI 306R when concreting during cold weather.

E. Installer Qualifications: A qualified installer who employs on the Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

F. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer shall be certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities." The certificate shall indicate that the plant has automatic batching and recording capabilities such that requirements of CBC 1705.3.3.1 are met.

G. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

H. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

I. Pre-installation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
   e. Special concrete finish subcontractor.
2. As applicable to the Work, review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures and concrete protection.

J. Mock-up
1. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish as result of formwork.
   a. Panel Size: Sufficient to illustrate full range of treatment.
2. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.
3. Mock-up may not remain as part of the Work.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

C. Warrant concrete floor sealer to be free from manufacturing defects for a period of 15 years. Applications completed by an approved installer in accordance with published technical data will be warranted for the suppression and control of water vapor emission, alkalinity, and relative humidity from concrete during the warranty period.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of ASTM C595/C595M for packaging and marking for cement delivery.

PART 2 PRODUCTS

2.01 GENERAL

A. Regulations: Refer to Section 014533 regarding compliance with applicable codes and regulations.

B. Comply with ACI 301 and ACI 318 for interpreting design requirements of reinforced concrete.
   1. Contractor shall keep a copy of ACI Field Reference Manual MNL-15(16) in the field office.

C. Comply with, regulations of the air quality management district in force at the time of the performance of the work of this Section regarding sealers and curing compounds.

D. Finish concrete surfaces shall be stable, firm, and in compliance with CBC Section 11B-403 requirements for slip resistance.
   1. Concrete paving shall have a minimum slip resistance coefficient of friction of 0.6 as tested in accordance with ASTM D2047.
   2. Refer to Part 3 for non-slip finish procedures at exterior concrete platforms, steps, and ramps.

E. Sloping Floors:
   1. The running slope of walking surfaces shall not be steeper than 1:20.
   2. The cross slope of walking surfaces shall not be steeper than 1:48.
   3. At plazas where there is no dominant direction of travel, and at turns, slope shall not exceed 1:48 in any direction.

2.02 FORMWORK

A. Comply with requirements of Section 031000.

2.03 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 032000.

2.04 CONCRETE MATERIALS

A. Hydraulic Cement: Type as indicated on drawings
   1. Acquire cement for the entire project from the same source
   2. Color: Standard Gray UNO.

B. Normal Weight Aggregates: ASTM C33/C33M and CBC 1909.2.1.
   1. Aggregate shall be nonreactive as determined by one of the methods in ASTM C33/C33M Appendix XI: Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate.
   2. Fine Aggregate: Washed natural sand consisting of hard particles, containing not more than the maximum limits of deleterious material allowed by Table 1 of ASTM C33/C33M.
      a. Fineness modulus shall be in the range of 2.90 to 3.10.
   3. Coarse Aggregate, Structural Concrete:
      a. Clean washed gravel or sound crushed rock, containing not more than 5 percent flat, thin, elongated, or laminated material, and containing not more than the maximum limits of deleterious material allowed by Table 3 of ASTM C33/C33M for moderate weathering regions.
         1) Grade 1-inch aggregate from No. 100 sieve to 1 inch.
         2) Grade 1-1/2-inch aggregate from No. 100 sieve to 1-1/2 inches.
      b. Maximum Size: As indicated on drawings and as noted below.
         1) Aggregate shall be no larger than:

(a) 3/4 of the clear space between reinforcing bars or between reinforcing bars and forms
(b) 1/5 of the narrowest dimension between sides of forms
(c) 1/3 of the depth of slab.

2) 3/8" aggregate may be utilized at areas of congestion only when submitted for review, indicating specifically where intended use will be, and approved by the architect.
3) Pea Gravel shall not be used.

4. Acquire aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C330/C330M.
1. Provide lightweight aggregates having a loss of not more than 8 percent when tested by sodium sulfate solution and a loss of not more than 10 percent when tested by magnesium sulfate solution in accordance with ASTM C 88
2. Maximum Size: 3/4 in or as noted below.
a. Aggregate shall be no larger than:
1) 3/4 of the clear space between reinforcing bars or between reinforcing bars and forms
2) 1/5 of the narrowest dimension between sides of forms
3) 1/3 of the depth of slab.

D. Fly Ash: ASTM C618, Class C or F.

E. Slag Cement: ASTM C989/C989M

F. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

G. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.

H. Water: ASTM C1602/C1602M; clean and not detrimental to concrete.

2.05 ADMIXTURES

A. General:
1. Admixtures and additives shall be reviewed by architect prior to use.
2. Admixtures and additives shall be incorporated and tested in accepted combinations and mixes
3. Admixtures containing chlorides will not be permitted.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
1. Manufacturers:
a. Euclid Chemical Company; PLASTOL 6420: www.euclidchemical.com/#sle.
b. Master Builders Solutions; MasterRheobuild 1000: www.master-builders-solutions.com/en-us
c. Substitutions: See Section 016000 - Product Requirements.

D. Water Reducing Admixture: ASTM C494/C494M Type A.
1. Water reduction: Not less than 5%.
2. Increase in compressive strength: Not less than 10% at 28 days.
3. Dry Shrinkage: Less than concrete without admixture at 21 days.
4. Manufacturers:
a. Euclid Chemical Company; EUCON NW: www.euclidchemical.com/#sle.
b. Substitutions: See Section 016000 - Product Requirements.

E. Shrinkage Reducing Admixture:
1. ASTM C494/C494M, Type S.

2. Manufacturers:
   a. Euclid Chemical Company; Eucon SRA Floor: www.euclidchemical.com/#sle.
   b. Euclid Chemical Company; Eucon SRA-XT: www.euclidchemical.com/#sle.
   c. Substitutions: See Section 016000 - Product Requirements.

F. Plasticizer: ASTM C494/C494M , Type F

2.06 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Min 15 mils thick, reinforced high density polyethylene sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
   1. Water Vapor Permeance: 0.02 Perms maximum, in accordance with ASTM E154/E154M Section 7.
   2. Puncture Resistance: 2200 grams minimum, in accordance with ASTM D1709 Method B.
   3. Tensile Strength: 45 lbf/in minimum, in accordance with ASTM E154/E154M Section 9, Method ASTM D882.
   4. Installation: Comply with ASTM E1643.
   5. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   6. Manufacturers: Comply with ASTM C755
      a. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
      b. Stego Industries, LLC: www.stegoindustries.com/#sle.
      c. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

B. Subslab Waterproofing (At Floor Slabs Subject to Minor Hydraulic Moisture Pressures): Vapor barrier under slab on grade with hydraulic moisture pressures or wet soils.
   1. Reinforced high density polyethylene (HDPE), mylar geomembrane, or 1/8-inch thick pre-molded membrane having the following minimum properties:
      a. Water Vapor Permeance: 0.005 Perms maximum, in accordance with ASTM E96/E96M.
      b. Water Vapor Barrier Classification: Class A, in accordance with ASTM E1745.
      c. Puncture Resistance: 2400 grams minimum, in accordance with ASTM D1709 Method B.
      d. Tensile Strength: 70 lbf/in minimum, in accordance with ASTM E154/E154M Section 9, Method ASTM D882.
   2. Accessory Products: Provide vapor proofing mastic, pipe boots, and related accessory products recommended by manufacturer of vapor retarder.
   3. Manufacturers: Comply with ASTM C755.
      a. Alumiseal Corporation; Alumiseal Zero Perm Vapor Barrier.
      b. Reef Industries; Griffolyn VAPORguard.
      c. Stego Industries, LLC; Stego Wrap 15-Mil Class A Vapor Barrier.
      d. Substituitions: See Section 016000 - Product Requirements
   4. Seam Tape:
      a. High density reinforced polyethylene vapor retarding seam tape with pressure sensitive adhesive as recommended by manufacturer of vapor retarder/barrier. Minimum 6 inches in width and of a contrasting color.
   5. Non-Shrink Cementitious Grout:
      a. Non-Shrink Grout: Prepackaged, non-metallic, non-gaseous, aggregate grout complying with ASTM C1107/C1107M. Contractor shall select type for each special application as recommended by manufacturer.

b. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: As indicated on the Contract Drawings.
c. Flowable Products:
   1) Euclid Chemical Company; NS GROUT: www.euclidchemical.com/#sle.
   2) Five Star Products, Inc; Five Star Fluid Grout 100: www.fivestarproducts.com/#sle.
   3) The QUIKRETE Companies; QUIKRETE® Exterior Use Anchoring Cement: www.quikrete.com/#sle.
   4) Substitutions: See Section 016000 - Product Requirements.
d. Low-Slump, Dry Pack Products:
   1) Euclid Chemical Company; DRY PACK GROUT: www.euclidchemical.com/#sle.
   2) Five Star Products, Inc; Five Star Grout: www.fivestarproducts.com/#sle.
   3) The QUIKRETE Companies; QUIKRETE® FastSet™ Non-Shrink Grout: www.quikrete.com/#sle.
   4) Substitutions: See Section 016000 - Product Requirements.

6. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, non-metallic aggregate, and activator.
   a. Minimum Compressive Strength at 7 days, ASTM C579: 12,000 pounds per square inch.
   b. Manufacturers:
      1) Euclid Chemical Company; E3-DEEP POUR: www.euclidchemical.com/#sle.
      2) Five Star Products, Inc; Five Star DP Epoxy Grout: www.fivestarproducts.com/#sle.
      3) Five Star Products, Inc; Five Star HP Epoxy Grout: www.fivestarproducts.com/#sle.
      4) Substitutions: See Section 016000 - Product Requirements.
7. Patching Mortar:
   a. Provide Polymer modified portland cement mortar. Compressive strength shall equal or exceed compressive strength of substrate concrete.
   b. Mortars shall conform to ASTM C928.
   c. Manufacturers:
      1) Horizontal Application:
         (a) Durapatch Industrial, manufactured by L&M Construction Chemicals.
         (b) Embeco R310, manufactured by BASF Admixture Systems.
         (c) ProSpec Vinyl Concrete Patch, as manufactured by Bonsal American.
      2) Vertical and Overhead application: equal to:
         (a) Durapatch VOH, manufactured by L&M Construction Chemicals.
         (b) Emaco R350, manufactured by BASF Admixture Systems.
         (c) ProSpec Vertical Leveling Mortar, as manufactured by Bonsal American.
8. Floor Leveling Compound: Two-part acrylic polymer latex concrete with compressive strength as tested by ASTM C109/C109M equal or greater than substrate concrete compressive strength.
   a. Manfacturers:
      1) Ardex; K-15.
      2) L&M Construction Chemicals; Levelex.
      3) Maxxon Corporation; Level-Right Plus.
      4) Substitutions: See Section 016000 - Product Requirements
9. Floor Patching Materials:
   a. Patching Materials shall match or exceed compressive strength of the substrate concrete.

1) Interstate Epoxy Patching Compound.
2) Sakrete Fast Setting Cement Patcher.
3) ProSpec Floor Patch Pro, manufactured by Bonsal American.

10. Skim Coat: Blended compound of portland cement, graded silica aggregates, and special chemical additives formulated for bonding, smoothing, rubbing, and thin coating concrete surfaces.
    a. Pavecrete manufactured by Lyons Manufacturing or Rapid Set WunderFixx manufactured by CTC Cement.
    b. Bonding Agent: Manufacturer's Type II acrylic bonding agent, when applicable. Do not use PVA Type I bonding agents.
    c. Pigment: SGS ColorFlo Liquid iron oxide color pigments, as manufactured by Solomon Colors, or equal, in accordance with ASTM C 979.
    d. Admixture: Chromix-L manufactured by L.M. Scofield Products, or equal product manufactured by Davis Colors.
11. Isolation Joint Sealant: Provide polyurethane type compatible with fiber joint filler.

2.07 BONDING AND JOINTING PRODUCTS

A. Chemical Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II. Agent shall be freeze-thaw resistant and suitbable for brush or spray application.
    1. Manufacturers:
        a. Euclid Chemical Company; AKKRO-7T: www.euclidchemical.com/#sle.
        b. Larsen Products Corp.; Weldcrete.
        c. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com/#sle.
        d. W. R. Meadows, Inc; ACRY-LOK-: www.wrmeadows.com/#sle.
        e. Substitutions: See Section 016000 - Product Requirements.

B. Waterstops: Rubber, complying with COE CRD-C 513.
    1. Configuration: As indicated on drawings.
    2. Size: As indicated on drawings.

C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

D. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

2.08 CURING AND SEALING MATERIALS

A. Floor Liquid Curing Compound Type FCC: For use on concrete slabs that will be exposed with separately applied floor sealer finish, or on slabs that will be covered by breathable floor coverings or mortar beds.
    1. Compound shall be a water-based non-staining dissipating, translucent resin, conforming to ASTM C309, Type 1, Class B.
        a. Sodium silicate compounds will not be permitted.
    2. Product shall be compatible with subsequently applied toppings (sealers, hardeners, finishes, or coverings).
    3. Manufacturers:
        a. Euclid Chemical Co,; Kurex Vox.
        b. L&M Construction Chemicals; L&M Cure R.
        c. Sonneborn Building Products; Sonosil.
        d. W.R. Meadows; Sealtight 1100 Clear.
        e. Substitutions: See Section 016000 - Product Requirements

B. Curing Barriers:
   1. Waterproof Curing Paper: Conform to ASTM C171, non-staining reinforced type.
      a. Manufacturer:
         1) Fortifiber Corporation; Orange Label Sisalkraft.
   2. Reinforced Curing Barriers: Transguard 4000 manufactured by Reef Industries or equal.

C. Floor Remedial Vapor Emission and Alkalinity Control Sealer Type FCS: For remedial use on concrete slabs on grade that do not meet manufacturer's specific moisture emission and alkalinity limits for non-breathable floor finishes.
   1. Manufacturers:
      a. Sinak Corporation; Sinak VC5: www.sinak.com.
      b. Bonsal American; ProSpec Moisture Guard Max.
      c. Synthetics International; Synthetic30 two-component liquid-applied, waterborne polymer-based ultra-low viscosity clear sealer. www.syntheticsintl.com.
      d. Substitutions: See Section 016000 - Product Requirements

D. Floor Sealer Finish Type FSF: For general use at exposed concrete slab areas for appearance.
   1. Design is based on the use of high solids, minimum 25% non-yellowing water-based acrylic cure/sealer conforming to ASTM C309, Type 1, Class B and ASTM C1315, Type 1, Grade B, low VOC compliant meeting all local air quality regulations.
   2. Product shall be in compliance with volatile organic compounds (VOC) content limits required by air quality management district at the time of performance of the work.
   3. At Exposed Concrete Surfaces at Garage Areas:
      a. Compound shall be a water-based non-staining dissipating, translucent resin, conforming to ASTM C309, Type 1, Class B.
   4. Sodium silicate compounds will not be permitted.
   5. Manufacturers:
      a. Euclid Chemical Co.; Euclid Aqua Cure VOX Super.
      b. L&M Construction Chemicals; Dress & Seal WB30.
      c. W.R. Meadows; VOComp 25.
      d. Sinak Corporation; HLQ-125.
      e. Substitutions: See Section 016000 - Product Requirements

E. Wall Sealer and Water Repellent Finish Type WSR: For general use at exposed concrete wall surfaces in Restrooms for code compliance.
   1. Design is based on the use of a modified neat silane repellent system offering invisible protection and low volatility combined with water and oil repellency on concrete substrates to prevent staining by waterborne and oily substance.
   2. Product shall be in compliance with volatile organic compounds (VOC) content limits required by air quality management district at the time of performance of the work.
   3. Manufacturers:
      a. Miracle Sealants Co.; 511 Impregnator.
      b. Prosoco, Inc.; Stand Off SLX100 Water & Oil Repellent.
      c. Substitutions: See Section 016000 - Product Requirements.

2.09 CONCRETE MIX DESIGN

A. Global Warming Potential (GWP) Limit: As Indicated, per mix
   1. Exception: Concrete may be considered one product category. A weighted average of the maximum GWP for all concrete mixes installed in the project shall be less than the weighted average maximum GWP specified on the structural drawings. Calculation shall be submitted to the Architect (Engineer) for approval

B. Mix design shall be stamped and signed by a professional engineer licensed in the State of California.

C. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

D. Proportioning Structural Lightweight Concrete: Comply with ACI PRC-213 recommendations.

E. The proportioning of ingredients shall be such that the concrete can be readily worked into forms and around reinforcement under the conditions of placement to be used, without segregation or excessive bleeding.

F. Concrete Compressive Strengths: Provide compressive strengths as noted on drawings, when tested in accordance with ASTM C39/C39M at 28 days.
   1. Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
      a. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

G. Water-Cementitious Material Ratio: As indicated on the Contract Drawings

H. Maximum Slump: As indicated on the Contract Drawings

I. Accurately control the proportions, water content, and air content. Use weighing equipment accurate to within 1 percent for cement and 2 percent for aggregates, and adjustable for varying aggregate moisture content. A beam auxiliary shall register any part of the last 100 pounds of each aggregate. The aggregate hopper shall have a volume adjustment.
   1. Proportion concrete by weight of loose, dry material.
   2. Fine aggregate volume shall be at least 35 percent of the sum of the separate fine and coarse aggregate volumes.

J. Admixtures: Admixtures may only be used if they are incorporated into the accepted concrete mix designs and testing. Where admixture is proposed for use by concrete supplier, conform to types accepted by Architect in writing.
   1. Proposed admixtures shall be as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

K. Fiber Reinforcement: Add to mix at rate indicated on drawings and in accordance to manufacturer's instructions. Provide uniform and complete distribution based on manufacturer's recommendations.

L. Tests for Concrete Materials at Batch Plant: Utilizing batch plant test records, perform the following tests in accordance with provisions of the building code:
   1. Cement: Sample and test cement, or provide mill test reports, as accepted, certifying that the cement conforms to the requirements of this Specification.
   2. Aggregate:
      a. Sample and test concrete aggregate for grading and soundness before concrete mix designs are established.
      b. Test aggregate for shrinkage characteristics in accordance with ASTM C157/C157M.
      c. Conduct petrographic examinations of aggregate proposed for use in accordance with ASTM C295/C295M.
   3. Air Content: ASTM C173/C173M, volumetric method or ASTM C231/C231M, pressure method. One test for each set of compressive strength test specimens.
   4. Refer to "Field Quality Control" in Part 3 for testing of actual concrete mix and placement.

M. Inspection: Accompany each load of materials or concrete with a signed copy of batch plant's certificate stating quantity of each material, design strength, amount of water added at plant, admixtures, departure time and date, and maximum amount of water allowed to be added at site.

N. Shrinkage Test:
   1. Before placing any concrete, prepare a trial batch of the mix design, using the same aggregates, cement, and admixtures (if any) proposed for use on the project. Prepare at least three specimens for determining the drying shrinkage of the mix design.

2. The drying shrinkage specimens shall be 4"x4"x11" prisms, made, cured, dried, and measured as specified in ASTM C157/C157M7. Measure and report separately for 7, 14, 21, and 28 days of drying. After 7 days of moist curing. The effective gauge length of the specimens shall be 10 inches.
3. The average drying shrinkage of the test specimens after 28 days of drying shall not exceed 0.045 percent for footing and grade beams, and 0.035 percent for all other locations. Use adequate amount of shrinkage reducing admixture as required.

2.10 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M and ASTM C94/C94M.
   1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 60 seconds for each additional 1 cu. yd. (0.76 cu. m).
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.
   4. Colored Concrete: Add pigments in strict accordance with manufacturer's instructions to achieve consistent color from batch to batch.
   5. Fiber Reinforcement: Batch and mix as recommended by manufacturer for specific project conditions.

B. Transit Mixers: Comply with ASTM C94/C94M.
   1. With each load, provide ticket certifying the materials and quantities as well as compliance with the accepted mix design.

C. On the transit mix ticket, state the time water was first added to the mix.
   1. At the batch plant, withhold 2-1/2 gallons of water per cubic yard of concrete.
   2. Upon arrival at the job site, as directed by the Testing Laboratory Inspector, add all or part of the withheld water before the concrete is discharged from the mixer.
   3. Mix concrete for not less than 5 minutes after the withheld water has been added, and not less than 1 minute of that time immediately prior to discharge of the batch.
      a. Drum shall rotate approximately 70 to 100 revolutions at a mixing speed of approximately 6 to 18 rpm.
      b. After mixing, drum shall rotate at an agitating speed of approximately 2 to 6 rpm.
      c. Unless otherwise directed, provide 15 minutes total mixing per batch after first addition of water.
   4. Discharge of the concrete shall be completed within 90 minutes after water is introduced into the mix, or before the drum has completed 300 revolutions.

D. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

E. Weather Requirements:
   1. Hot Weather Usage: Adjust mix as required to counteract effects of anticipated or probable hot weather on strength of concrete. Conform to recommendations of ACI 305R regarding admixtures, temperature of mixing water, and delivery times.
      a. During hot weather, proper attention shall be given to ingredients, production methods, handling, placing, protection and curing to prevent excessive concrete temperatures or water evaporation that may impair required strength or serviceability of the member or structure.

b. When air temperature is between 85 degrees F. and 90 degrees F, limit mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F, limit mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to performing work and placing concrete, verify:
   1. Lines, levels, and dimensions before proceeding with work of this section.
   2. Elevations and depressions of floor finishes
   3. Final excavation required for foundations and footings prior to placing concrete.
   4. Locations of proposed and future breathable and nonbreathable floor finishes in advance of placing concrete to determine type of floor sealers to be applied in finishing operations.
   5. Formwork is properly located such that the unshored concrete will maintain specified tolerances after forms are removed.

3.02 PREPARATION

A. Formwork: Comply with Section 031000 - Concrete Forming and Accessories.

B. Reinforcing: Comply with Section 032000 - Concrete Reinforcing.

C. Verify that forms are clean and free of rust before applying release agent.

D. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

E. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning, roughening to exposed aggregate, and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use latex bonding agent only for non-load-bearing applications.

F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade over properly prepared subbase per Geotechnical recommendations. Lap joints minimum 6 inches. Tape and seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
   1. Place Slab on Grade directly on vapor retarder.
   2. Avoid grade staking through vapor retarder.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.
   1. Pour concrete in accordance with accepted pour schedule and construction joint layout.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 48 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Place concrete continuously between predetermined construction joints per ACI and CBC requirements. Where construction joints are located, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

H. Compacting:
   1. General: Spade, rod, vibrate, and consolidate concrete in forms. Vibrators shall not be left in any one spot longer than 30 seconds and shall be kept constantly in motion. One vibrator shall be assigned to each location where concrete is being placed and a standby vibrator shall be kept ready at all times. Avoid creating rock pockets, air bubbles, honeycomb, or separation of ingredients.
   2. Work concrete thoroughly around reinforcement and embedded items and into corners and angles of forms by spading, rodding, and tamping.
   3. Consolidation: Vibrate to consolidate each layer with previously placed layers, completely embedding reinforcing and fixtures, and bringing fine material to surface of slab to produce proper finish.

I. Hot Weather Placing: Comply with recommendations of ACI 305R.

J. Cold Weather Placing: Comply with recommendations of ACI 306R.

3.04 GROUTING

A. Non-Shrink Grout: Install non-shrink grout per drawing properly beneath bearings of plates, columns, and other structural members using product recommended by manufacturer for specific application and in accordance with printed instructions.
   1. Compressive strength of grout shall be tested in accordance with ASTM C109/C109M .

3.05 CONTROL AND CONSTRUCTION JOINTS

A. Control Joints:
   1. Location: As indicated on the Contract Drawings, but not more than 20 feet on centers in both directions at exterior slabs. Limit interior slabs on grade to 400 square foot bays with length to width ratios of 1 to 1.5 maximum.
      a. Locate on column center lines and at re-entry corners wherever practical.
      b. Avoid areas receiving tile or paver floor finish.
      c. Coordinate locations with proposed floor finish joint layout.
      d. Limit length to width ratios to 1 to 1.25.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; with width and depth as indicated on drawings.
   1. Fill saw cuts in interior walkways with control joint filler specified.

E. Construction Joints:
   1. Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:
   2. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.
   3. A mix containing the same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.
   4. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.

3.06 SEPARATE NON-STRUCTURAL FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Non-structural toppings slabs shall be normal-weight concrete, reinforced as noted on the Contract Drawings.

D. Place concrete floor toppings to required lines and levels.
   1. Place topping in checkerboard panels not to exceed 20 feet in either direction.

3.07 TOLERANCES FOR CONCRETE CONSTRUCTION AND MATERIALS

A. An independent testing agency, as specified in Section 014000, will inspect finished slabs for compliance with specified tolerances.

B. Conform to requirements of ACI 117, except as modified by the requirements of these Specifications and CBC.

C. Formed Surfaces:
   1. Maintain bowing, warping, and dimensional tolerances within the maximum tolerances stated in ACI 117 for Class A surfaces.
   2. Overall Dimension for Height and Width: Plus zero to minus 3/32-inch for surfaces that are 10 feet and over.
   3. Thickness: Plus-or-minus 1/8-inch maximum.
   4. Openings: Accurate to within a tolerance of plus 1/8-inch to minus zero.
   5. Exposed Slab Edges: Free of jogs exceeding 1/8-inch.

D. Concrete Slabs: Floor finish tolerances shall be measured in accordance with ASTM E1155/E1155M and ACI 302.1R the F-Number System (Inch-Pound Units) for the following conditions:

Element	Specified Overall Value		Minimum Local Value	
	FF	FL	FF	FL
Slab-on-Grade:				
Mech and Electrical Rooms, parking structures	20	15	15	10
Carpeted	25	20	17	15
Thinset Tile, Resilient Flooring	35	25	24	17
Wood Flooring	50	35	35	35
Other not indicated	35	25	24	17
Suspended Slabs:				
Mechanical and Electrical Rooms, parking structures	20	15 (SHORED)	N/A	N/A
Carpeted	25	20 (SHORED)		
Thinset Tile, Resilient Flooring	35	25 (SHORED)		
Wood Flooring	50	35 (SHORED)		
Other not indicated	35	25 (SHORED)		

E. Verify flatness requirements in accordance with Owner's specification requirements prior to installation.

F. Suspended Slab Levelness: Where FL is not specified (unshored conditions) floors must be level, and the elevation of the top surface shall fall within a 3/4-inch envelope in accordance with ASCC Tolerances for Suspended Concrete Slabs, unless part of a sloping floor or as otherwise noted.

G. Concrete Door Sills:
   1. Slabs Under Operable Partitions or Sound-Rated Accordion Doors: 1/8-inch from level along line under partition or door.
   2. Slabs Under Roll-up Doors: 1/8-inch from level along line under partition or door.

H. Levelness tolerances shall be measured within 72 hours after slab concrete placement.
   1. Tolerances for sloped floors shall not exceed the slopes specified in "REGULARTORY REQUIREMENTS" in Part 2.

I. Owner reserves the right to test floors and concrete members for conformance to ACI 117 by Use of the Dipstick Floor Profiler. Should tolerances not be within the limits specified, the Contractor shall be required to pay the cost of the tests, as well as the repairs required to bring work into compliance.

J. Corrective Procedures: See "FILLING, LEVELING AND PATCHING."
   1. Areas requiring corrective work should be identified and submitted to Architect. Re-measure corrected areas by the same process.

3.08 CONCRETE FINISHING

A. Formed Concrete
   1. Surface Repairs: Repair surface defects, including defective areas and tie holes as recommended in ACI 301 Section 2 or 6.
   2. Rough-Formed Finish: Cast concrete texture imparted by form-facing material, not arranged in any specific visual manner. Repair and patch tie holes and defective areas. Rub down or chip off fins and other projections exceeding 1/4-inch in height.
      a. Apply to concrete surfaces not exposed to public view.
   3. Smooth-Formed Finish: Cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.
      a. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, damp-proofing, veneer plaster, or painting.
      b. Apply the following rubbed finish, defined in ACI 301 Section 6, to smooth-formed finished concrete.
         1) Grout-cleaned finish.
         2) Smooth-rubbed finish.
   4. Painted Finish: Entire surface area exposed to view shall be free of voids, cracks, spalls, protrusions, or non-uniform textures.
      a. Prior to sacking, prepare surfaces in accordance with Section 099113 - Exterior Painting and Section 099123 - Interior Painting as applicable.
      b. Entire surface area of concrete exposed to view shall be repaired, resurfaced, and made ready to receive paint finish specified under Section 099113 - Exterior Painting and Section 099123 - Interior Painting as applicable.
         1) Resurfacing of concrete panel surfaces shall be accomplished with specified resurfacing materials in accordance with manufacturer's instructions and the preparation and application procedures of ACI 503.4.
      c. Interior surfaces at window openings shall be ground smooth, resurfaced, and prepared to receive sealants.

1) Resurface concrete sills, jambs, and heads with specified resurfacing, patching, and finishing materials in accordance with manufacturer's instructions.
(a) Interior surfaces at openings shall be ground smooth, resurfaced, and prepared to receive sealants.

d. Finish repaired surfaces with primer and two coats of paint finish as specified under Section 099113 - Exterior Painting and Section 099123 - Interior Painting as applicable.

5. Related Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
6. Electrostatic Coatings: Install in accordance with manufacturer's printed instructions.
7. Patching and Skim Coating: Refer to "FILLING, LEVELING AND PATCHING."

B. Flatwork
1. Screeding: Work out irregularities and bring surfaces to true finish grade or elevation. Remove excess water and debris worked to the surface during compaction and screeding.
2. Initial Troweling:
a. Do not commence troweling until surface water sheen has disappeared.
b. Use wood bullfloats to open top of slab to allow bleed water out.
c. Do not use metal floats.
d. Do not apply dry cement, sand, or water to surface.
e. Slabs to Receive Mortar-bed with Topping or Bonded Finish: Upon completion of pour, and before concrete has hardened, texture surface of slab with stiff broom, or roughen surface.
f. Slabs to Receive Crack Isolation Membrane or Mortar-bed with Cleavage Membrane: Finish slabs with typical smooth troweled surface.
3. Final Troweling:
a. Interior Slabs: Steel trowel and burnish.
1) Do not finish slab until bleed water has evaporated.
2) Do not apply water to the concrete during finishing.
3) Do not allow rainwater to stand on slab.
b. Sills and Other Weather Surfaces: Smooth trowel and burnish. Finish external angles uniform and tooled.
c. Sealer: Where specified, apply in accordance with the requirements of Section 033511.
4. Finish for Interior Stairs:
a. Sprinkle abrasive aggregate uniformly on unhardened surface immediately prior to finishing, at the rate of 2 pounds per square yard. Work into surface during finishing. Rub lightly to expose abrasive aggregate while concrete is green.
b. Concrete walking surfaces shall have a minimum slip resistance coefficient of friction of 0.6 as tested in accordance with ASTM D 2047.
c. Stairs: Apply grooves and tooled edges to tread nosing in accordance with the Contract Drawings.
1) Provide medium broom finish.
d. Warning Stripes: Apply 2-inch wide warning stripe of 70 percent contrasting color at top and bottom nosing of each run at interior stairs, 1 inch maximum from edge of nosing.
e. Pedestrian, General:
1) Provide medium broom finish.
2) Medium acid etch finish.
5. Float Finish:

a. After screeding, consolidating, and straightening concrete slabs, do not work surface until ready for floating.
b. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats. The application of Portland cement to slab during floating or troweling is prohibited.
c. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and frill low spots. Repeat float passes and straightening until surface is left with a uniform, smooth, granular texture.
d. Finish to straightedge tolerance.
e. Cut down high areas and fill in low areas.
f. After straightening, refloat surface to uniform, smooth, granular texture.
g. Locations:
    1) Surfaces scheduled for trowel and broom finishes.
    2) Surfaces scheduled to receive adhered roofing or waterproofing membrane.
    3) Surfaced scheduled to receive thick-set mortar beds on cleavage membrane.

6. Trowel Finish:
    a. After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
    b. Finish to straightedged tolerance.
    c. Locations:
        1) Surfaces scheduled to receive thin-set mortar beds, resilient flooring, carpet, and wood flooring.
        2) Exposed surfaces.
        3) Surfaces scheduled to receive paint or other thin film finish coating.
7. Medium Broom Finish:
    a. Provide float finish and let set.
    b. While surface is still plastic draw medium stiff fiber bristle broom uniformly over surface to provide texture perpendicular to main traffic direction.
    c. Locations:
        1) Stair treads.
8. Heavy Broom Finish:
    a. Provide float finish and let set.
    b. Texture: While surface is still plastic, swirl stiff fiber bristle broom uniformly over level surfaces and perpendicular to main traffic direction at ramp surfaces.
    c. Locations:
        1) Parking garage areas.
9. Acid Wash: Top-Cast No. 3 Light Etch.
    a. Provide acid containment area and comply with CAL OSHA for application and cleanup.
    b. First Wash: Three days after pour.
    c. Second Wash: Three weeks after first application.
    d. Third Wash: At time of final completion of Project.
    e. Appearance: Slab surfaces shall exhibit an aggregate exposure of fine aggregate particles constituting not less than 60 percent and not more than 80 percent of the surface, as directed by Architect. Exposure shall be of sufficient depth to provide a surface profile of between 1/16-inch and 3/16-inch.
10. Electrostatic Control Coating: Install in accordance with manufacturer's recommendations.

C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:

1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.09 SEALING

A. Formed Concrete Surface:
   1. Interior Vertical Surfaces: Where indicated on Contract Drawings, treat vertical surfaces of interior exposed formed concrete with specified sealer finish Type WSR.
      a. Apply protective treatment in saturating applications without atomizing the product. Use enough to thoroughly wet the surface and create a slight rundown below the spray pattern. Apply uniformly. Don't over apply.
         1) Provide two applications of protective treatment at exposed concrete toilet room wall locations. Apply the second coat within a few minutes after the first coat has penetrated and appears dry; do not atomize the product during application.
      b. Brush heavy runs and drips thoroughly into the surface.
      c. Protect treated surfaces from contact or by water or for 4 hours.
   2. Exterior Vertical Surfaces: Where indicated on Contract Drawings, treat vertical surfaces of exterior exposed formed concrete with sealer in accordance with specified sealer finish Type FSF.

B. Flatwork
   1. Grind and clean floors prior to sealing.
   2. Sealer/Dustproofer:
      a. Prepare substrates and spray apply curing sealer in accordance with manufacturer's directions.
      b. Locations:
      c. Mechanical rooms, main trash room, electrical rooms, and telephone rooms.
      d. Other locations where indicated or scheduled in Contract Drawings.
   3. Penetrating Sealer:
      a. Sealed Concrete Type SC2: Polish with clear finish in accordance with Section 033513 - High-Tolerance Concrete Floor Finishing.

3.10 CURING

A. Comply with requirements of ACI 308R and ACI 318. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than seven days.

C. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing.

D. Surfaces Not in Contact with Forms:
   1. Curing Compound: Cure by completely and uniformly applying liquid curing compound in accordance with manufacturer's printed instructions. Apply at least two coats at right angles to each other.
      a. Reapply curing membrane at saw cut joints and at exposed edges of slab after removal of forms.
      b. Omit curing compound and use moisture curing where required to provide floor sealer.
      c. Omit curing compound where curing/sealing compound specified provides a concurrent curing function and is applied at the time of concrete placement appropriate to such function.

d. Slabs and floors to receive adhesive-applied flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Continuous Moisture: Cure by keeping concrete continuously wet for a period of at least 7 days after pouring in accordance with ACI 308R and ACI 318 for curing interior slabs to receive flooring finishes. During periods of high temperature, low humidity, or wind, wet concrete as often as required to keep concrete continuously moist for a period of at least 10 days. Cover with waterproof curing paper or reinforced vapor retarder, maintaining a film of water.
3. Final Curing: Begin after initial curing but before surface is dry.

E. Ambient Conditions:
1. Hot Weather Curing:
2. Conform to recommendations of ACI 305R regarding curing of concrete flatwork in hot weather.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed testing agency.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Testing:
1. Sample fresh concrete in accordance with ASTM C172/C172M, except modified for slump to comply with ASTM C94/C94M.
2. Slump: Test will be performed in accordance with ASTM C143/C143M. One test will be made for each concrete load at point of discharge and one test for each set of compressive strength test specimens.
3. Concrete Temperature: Test will be taken hourly when air temperature is 40 degrees F or below, and when 80 degrees F or above, and each time a set of compression test specimens is made.
4. Curing: Cure specimens in accordance with ASTM C31/C31M.
5. Frequency of Compressive Strength Testing: Test will be made in accordance with ASTM C39/C39M, ACI 318, CBC Chapter 19, and Table 1705.3.
a. Test one set of four cylinders for each concrete class placed in any one day for each 50 cubic yards or fraction thereof, or for each 2000 square feet of surface area placed. One specimen will be tested at 7 days, two at 28 days, and:
1) When frequency of testing will provide less than five strength tests for a given class of concrete, testing from at least five randomly selected batches, or from each batch if fewer will be conducted.
b. If the average of strength tests of all strength tests of a given class of concrete equals or exceeds the specified strength at 28 days, with no individual strength test less than 500 psi below that specified, the strength level of concrete will be considered satisfactory.
c. Retain one cylinder for testing at 56 days if 28-day test fails.

E. Moisture Vapor Emission Testing: After concrete slabs have cured and prior to installation of finish flooring materials, verify that moisture content and alkali content of concrete slabs do not exceed limits acceptable to manufacturer of flooring materials.

1. Testing Equipment: Test methods based on ASTM F2170 using RH meters and testing kits equal to AMT Moisture/Relative Humidity Meter manufactured by American Moisture Test, Inc., or equivalent by Vaprecision Testing Systems may be used at testing agency's option except at concrete floors with exposed or polished finish.
2. Alkalinity: Concrete pH test using calibrated digital 1-14 wide range pH meter equal to PH100 to determine alkalinity level in accordance with ASTM F710. Paper and pencil type tests are not acceptable.
3. Calcium Chloride Testing: After building air conditioning has been in operation for at least 15 days, calcium chloride and pH testing kits may be used: Prepackaged test kit of commercial consistency, equipped with a sealed dish of anhydrous calcium chloride, a metering dome with butyl rubber gasket and instructions for implementation. Weigh dishes on site prior to installation. Conform with requirements of ASTM F1869.

F. Vapor Emission and Alkalinity Testing:
1. Perform vapor emission and alkalinity testing and take appropriate action based on results in relation to finish floor manufacturer's moisture and alkalinity requirements.

G. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.12 FILLING, LEVELING AND PATCHING

A. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired, or as directed by LPA.
1. High spots shall be honed, or ground with power-driven machines to required tolerances with approval from LPA.
2. Low spots shall be filled with floor leveling compound, installed in accordance with manufacturer's written recommendations.

B. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.

C. Patching Exposed Concrete: After flushing with water, pack tie wire, nail, bolt, and core sample holes which will be exposed as soon as possible after form removal. Grout and repair rough pockets, cracks, or honeycomb. If patches are required, chip defective areas to a uniform depth of at least 1 inch with sides at right angles to surface.
1. Match surrounding concrete surfaces in color and texture. Make trial patch to determine color match. Before applying, moisten surrounding concrete and apply specified bonding compound.
2. Smooth Formed Concrete: Grind off ridges, offsets, and other prominent marks of smooth formed concrete while concrete is green and grind smooth. Sack exposed concrete surfaces.
    a. Painted concrete shall be considered as being exposed.
3. Patch defects deeper than 1/2-inch in panels with specified patching material and methods deemed by the LPA as the appropriate method to correct such defects.

D. Skim Coating: Where sack and patch is noted on Contract Drawings, apply to architectural formed cast-in-place concrete walls in accordance with manufacturer's instructions.
1. New concrete must be cured 28 days.
2. pH must be verified prior to skim coating application to determine if primer needs to be applied, as required by manufacturer.
3. Clean concrete in accordance with ASTM D4258.
4. Mixing Skim Coat:
    a. Add to water, adding only enough to make a stiff trowelable consistency like soft putty.
    b. Add color additive.

c. Working Time: Approximately 15 minutes.

5. Apply to walls with trowel in smooth uniform coat in continuous operations to maintain a uniform shade.
6. Patching: Broad deep areas in concrete surface shall be filled with skim coat material in accordance with manufacturer's directions prior to application of skim coat. Where surfaces are shiny smooth, apply manufacturer's Type II bonding agent.

E. Patching Unexposed Concrete: Ridges, offsets, and other prominent marks need not be ground off, cleaned, or sacked. This requirement applies to concrete areas that will be concealed by other construction.
1. Finish below-grade concrete indicated to receive waterproofing in the same manner as exposed, smooth-formed concrete, except that surfaces need not be sacked.
2. Patch and repair concrete slabs ready to receive future finish materials installed by Owner.

3.13 DEFECTIVE CONCRETE

A. Strength
1. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
2. If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, falls below minimum 28 days compressive strength specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.
3. Should strength of any grade of concrete, for any portion of Work indicated by tests of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective and shall be evaluated by LPA and replaced or adequately strengthened in a manner acceptable to the LPA and DSA.
4. Test Cores: Should required test cylinders fail to show minimum design compressive strength, take test cores at locations coordinated with the LPA.
a. If results show compressive strength to be less than design stress, concrete shall be deemed defective and shall be replaced in a manner acceptable to the Architect and DSA.
b. If results show compressive strength to conform to design stress, grout solid coring holes with grout exceeding design compressive strength and finish to match adjacent surface.

B. Concrete Work that is not formed as indicated, is not true within tolerances of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, cracked, contains sawdust shavings, wood or embedded debris, or does not fully conform to Contract provisions, shall be deemed to be defective Work and shall be removed and replaced.

C. Concrete substrates for non-breathable floor finishes that indicate by testing excess quantities of moisture and alkalinity shall require remedial measures, as specified in this Section.

D. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing, including patching for cores, shall be borne by Contractor when defective concrete is identified.

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

3.14 CLEAN UP

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

B. Wash and clean flatwork surfaces. Leave free from oil, paint, plaster, form coating, and other foreign substances, ready to receive scheduled finishes.

3.15 PROTECTION

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

B. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 042000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Mortar and grout.
C. Reinforcement and anchorage.
D. Flashings.

1.02 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories
B. Section 032000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
C. Section 076200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
D. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. The applicable version of the standards listed below shall be per Chapter 35 of Part 2 of the 2022 edition of the California Building Code (CBC), including addendums and errata. Where the standard is not listed, then the most current version of the standard shall be used or as referenced by other standards.
    1. ACI 216 - Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies.
    2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
    3. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
    4. ASTM C5 - Specification for Quicklime for Structural Purposes.
    5. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
    6. ASTM C91/C91M - Standard Specification for Masonry Cement.
    7. ASTM C110 - Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone.
    8. ASTM C114 - Method for Chemical Analysis of Hydraulic Cement.
    9. ASTM C140 - Sampling and Testing Concrete Masonry Units.
    10. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
    11. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
    12. ASTM C150/C150M - Standard Specification for Portland Cement.
    13. ASTM C207 - Specification for Hydrated Lime for Masonry Purposes.
    14. ASTM C260 - Specification for Air-Entraining Admixtures for Concrete.
    15. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
    16. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
    17. ASTM C426 - Test Method for Linear Drying Shrinkage of Concrete Masonry Units.
    18. ASTM C476 - Standard Specification for Grout for Masonry.
    19. ASTM C494 - Specification for Chemical Admixtures for Concrete.
    20. ASTM C744 - Specification for Prefaced Concrete and Calcium Silicate Masonry Units.

21. ASTM C979 - Specification for Pigments for Integrally Colored Concrete.
22. ASTM C1019 - Test Method of Sampling and Testing Grout.
23. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
24. ASTM C1714 - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry
25. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

B. California Code of Regulations (CCR):
   1. CBSC, Title 24, Part 2- California Building Code (CBC), 2022 edition.
      a. Chapter 17 - Structural Tests and Inspections.
      b. Chapter 21 - Masonry.

C. ICC Evaluation Service, Inc. (ICC ES), a subsidiary corporation of the International Code Council:
   1. ICC ES Evaluation Reports (ESR) for Materials, Products, Methods, and Types of Construction with current report conforming to the applicable building code.

D. International Association of Plumbing and Mechanical Officials (IAPMO):
   1. IAPMO Uniform Evaluation Service (UES) Report for Materials, Products, Methods, and Types of Construction with current report conforming to the applicable building code.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

D. Samples: Submit samples of units to illustrate color, texture, and extremes of color range.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

F. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

G. Installer's Qualification Statement.

H. Sustainable Design Submittals
   1. Material & Resources Submittals:
      a. Letter Template for MR Credit 2.1 and Credit 2.2: Letter template, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
         1) Comply with Section 017419 Construction Waste Management and Disposal.
      b. Product Data and Certification Letter for MR Credit 4.1 and MR Credit 4.2: Indicate percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
      c. Product Data for MR Credit 5.1 and MR Credit 5.2: For regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 UNIT MASONRY, GENERAL

A. Materials, construction and workmanship shall be in accordance with TMS 402/602 and CBC Chapter 21.

2.02 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and by thickness of wall as indicated on conctract drawings
      a. Cap units shall be 2 inches high by 16 inches long by thickness of wall.
   2. Shapes: Provide open end units typically.
      a. Bond Beam Block: Deep cut type.
      b. Provide lintel units over wall openings.
      c. Special Units: Provide cap, end, corner, pilaster, and other special units as required.
   3. Load-Bearing Units: ASTM C90, medium weight.
      a. Hollow block, as indicated.
   4. Nonloadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
   5. Average oven-dry density of solid grouted medium weight CMU block shall not exceed 115 pounds per cubic foot.
   6. Admixture: Add water repellent admixture to block mix used for exterior construction in accordance with recommendations of manufacturer.
   7. Surface Texture:
      a. Buildings: Provide smooth precision block surface, or as indicated on drawings.
      b. Site Walls: Ground-Face (Burnished) Units, or as indicated in drawings.
   8. Block Color:
      a. Smooth: Provide natural color unless noted otherwise on the Contract Drawings.
      b. Ground Face: Provide natural color unless noted otherwise on the Contract Drawings.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type II; color as required to produce approved color sample.

B. Hydrated Lime: ASTM C207, Type as indicated in drawings.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404, coarse type.

E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As indicated on drawings.

F. Water: Clean and potable.

G. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
   1. Use only in combination with masonry units manufactured with integral water repellent admixture.
   2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
   3. Meet or exceed performance specified for water repellent admixture used in masonry units.

2.04 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: Type specified in Section 032000; size as indicated on drawings.

B. Supports and spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

2.05 FLASHINGS

A. Metal Flashing Materials: As specified in Section 076200.

2.06 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Type as indicated on drawings.
   2. Minimum compressive strength of the mortar shall be as required to achieve the compressive strength (f'm) of masonry specified when combined with masonry units used in the structure.
   3. Proportion per CBC Ch 21 and TMS 402/602.
   4. Water Repellent Admixture: Add water repellent admixture to mortar mix in accordance with recommendations of manufacturer.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
   1. Minimum compressive strength of the grout shall be as required to achieve the compressive strength (f'm) of masonry specified when combined with masonry units used in the structure, with a minimum compressive strength of 2500 psi.
   2. Proportions: In accordance with ASTM C376.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

2.07 PERFORMANCE CRITERIA

A. Minimum specified average net area compressive strength (f'm) of masonry assembly shall be in accordance with the contract drawings.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Verify dowels are properly located.

D. Do not commence installation until foundations are clean, rough, and level, or until floor slabs are structurally sound. Clean projecting dowels free from loose scale, dirt, concrete, and other material that will inhibit bond.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 and CBC Chapter 21.

3.04 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. Concrete Masonry Units:
   1. Bond: As indicated on drawings.
   2. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Lay only dry masonry units

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners, except for units laid in stack bond.

G. Provide full mortar coverage on horizontal and vertical face shells and webs in courses of the following:
   1. Piers, columns, and pilasters.
   2. Starting course on footings and solid foundation walls. Provide full bedding under both the face shell and web.
   3. Where adjacent to cells or cavities to be filled with grout.

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

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

J. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

K. If necessary to stop a horizontal run of masonry, rack back one-half block length in each course. Do not use toothing to join new masonry to set or partially set masonry when continuing a horizontal run.

L. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

M. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

N. Horizontal and Vertical Face Joints:
   1. Thickness: 3/8-inch nominal, and uniform in appearance.
   2. When thumb-print hard, tool joints in exposed surfaces with round jointer for concave joint. Mortar joints shall be tooled only where walls will be left exposed.
      a. Compress and strike off for flush joints when serving as a base for plaster, textured coatings, membrane waterproofing or dampproofing.
   3. Remove mortar protruding into cells of cavities to be reinforced or filled.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Provide reinforcing as shown on contract drawings.

B. Install reinforcing in conformance with TMS 402/602.

3.07 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

3.08 GROUTED COMPONENTS

A. Lap splices as indicated on drawings.

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

C. Place and consolidate grout fill without displacing reinforcing.

3.09 CONTROL JOINTS

A. Continue horizontal joint reinforcement through control joints.

B. Size control joints as indicated on drawings.

3.10 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.11 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

3.12 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

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

3.13 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

3.14 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

3.15 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
   2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from mud and from mortar splatter by coverings spread on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

END OF SECTION

SECTION 044313
STONE MASONRY VENEER

PART 2 PRODUCTS

1.01 STONE

1.02 MORTAR APPLICATIONS

1.03 MORTAR MIXES

1.04 ACCESSORIES - ANCHORED VENEER

1.05 STONE FABRICATION - ANCHORED VENEER

END OF SECTION

SECTION 050511
SURFACE PREPARATION AND FINISHING OF METALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation, treatment, and finishing of metals and metal components specified in other Sections, including:
   1. Steel and iron surface preparation.
   2. Steel galvanizing.
   3. Steel Galvaneeling.
   4. Galvalume steel.
   5. Stainless steel.
   6. Weathering steel.
   7. Aluminum anodizing.

B. Shop priming of metals and metal components specified in other Sections for field finish.

1.02 RELATED REQUIREMENTS

A. Section 050513 - Shop-Applied Coatings for Metal; for coil and extrusion coatings for metal.

B. Section 051200 - Structural Steel Framing; for surface preparation of structural steel and primer to be applied to structural steel.

C. Section 099113 - Exterior Painting.

D. Section 099123 - Interior Painting.

E. Section 099600 - High-Performance Coatings.

1.03 DEFINITIONS

A. Mechanical Finish: Provides a surface texture by only mechanical means; does not use chemical, electrochemical treatment, or additive. Finished textures vary widely, based on grinding, polishing, and buffering operations, or combinations, used..
   1. Directional Textured Finish: Satiny sheen produced by tiny, nearly parallel scratches in the metal surface produced by wheel or belt polishing with fine abrasives, by hand rubbing with stainless steel wool, or by brushing with abrasive wheels.
   2. Non-Directional Textured Finish: Matte finish of varying degrees of roughness, produced by blasting sand, glass beads, or metal shot against the metal under controlled conditions. The smoothest finish is obtained by dust blasting with a very fine abrasive and by vapor honing with a slurry of extremely fine abrasive and water. Non-directional textured finishing is not recommended on material less than 1/4 inch thick, and a surface protective treatment is required.
   3. Patterned Finish: Produced by passing sheet between 2 machined matched design rolls, impressing patterns on both sides of the sheet (embossing), or between a design roll and a smooth roll which "coins" one side of the sheet only.

B. Chemical Treatment: Used as either processing for a final finish, or as a final finish.
   1. Surface cleaning only, such as degreasing.
   2. To produce a clean matte textured surface.
   3. To produce a smooth, bright finish.

4. To chemically convert the surface of the metal, providing a film which is a good substrate for coatings (conversion coating). Can be used to prepare the surface for painting or as a final finish.

C. Anodic Coating (Anodizing): Process in which metal is immersed in an acid solution (referred to as an electrolyte), and a direct current is passed between the aluminum and the electrolyte, with the metal acting as the anode. This results in the controlled formation of a durable aluminum oxide film or coating, which does not affect the surface of the metal, but greatly increases the metal's resistance to corrosion and abrasion.

D. Galvanizing: Process of applying a coating of zinc to steel or iron, to prevent rusting. The zinc protects the underlying metal by sealing the surface from airborne corrodents, and through galvanic action.

E. Galvannealing: Steel which is galvanized, then passed through air knives to remove excess zinc, and finally annealed in a furnace while the zinc is still in a fluid state. This produces a surface layer of zinc-iron alloy. Galvannealed steel has excellent welding and paint adhesion properties.

F. Metallic-Coated: Steel with a coating of metal by the hot dip process. Common coatings are galvanized, galvalume (55 percent aluminum-zinc alloy coated), and galvanealing.

G. Passivate: To protect a metal from corrosion by creation of an outer layer, through chemical reaction.

H. Weathering Steel: A type of steel which patinas under normal atmospheric conditions, protecting it from corrosion.

1.04 REFERENCE STANDARDS

A. AA DAF-45 - Designation System for Aluminum Finishes; 2003 (Reaffirmed 2009).

B. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

D. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2025b.

E. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance; 2019.

F. ASTM A606/A606M - Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance; 2018.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

H. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025.

I. ASTM D6386 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting; 2022.

J. ASTM D7803 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating; 2019.

K. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024, with Errata (2025).

L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

M. SSPC-SP 3 - Power Tool Cleaning; 2024.

N. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

O. SSPC-SP 16 - Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals; 2020.

1.05 SUBMITTALS

A. Refer to submittals in other Sections which specify finishes in this Section.

B. Maintenance Materials: Where field repair of shop-applied coating is acceptable, provide container of material to perform minor corrective work.

1.06 COORDINATION

A. Confirm treatment of metal is compatible with and allows specified warranty for paint and coating systems specified in other sections.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Apply standard protective coverings to finished surfaces.

1.08 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions by field measurement before fabrication. Show recorded measurements on shop drawings.

B. Ambient Conditions:

1.09 WARRANTY

A. Applicator's Warranty: Applicator agrees to repair finish of replace coated metal products that demonstrate deterioration of factory-applied systems within warranty period.
   1. Class I anodized finish: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

2.02 PERFORMANCE REQUIREMENTS

A. Shop-applied finishes to meet or exceed minimum performance requirements in this Section.

2.03 STEEL AND IRON SURFACE PREPARATION

A. Prepare metal surfaces according to SSPC standards prior to application of coatings listed in this and other Sections.
   1. Structural Steel: See 051200 - Structural Steel Framing, for surface preparation of structural steel.
   2. SSPC-SP 3: Power Tool Cleaning.
      a. Description: Requirements for power tool cleaning of steel surfaces. Power tool cleaning removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.
      b. Use for the following:
         1) Steel items not otherwise listed below.

3. SSPC-SP 6/NACE No.3: Commercial Blast Cleaning.
    a. Description: Requirements for commercial blast cleaning of uncoated or coated steel surfaces by the use of abrasives. A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter. Random staining shall be limited to no more than 33 percent of each unit area of surface, and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating.
    b. Use for the following:
        1) Exterior items.
        2) Items indicated to receive zinc-rich primer.
4. SSPC-SP 16: Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
    a. Description: Requirements for roughening and cleaning hot-dip galvanized surfaces to create a profile suitable for painting or coating. Completion of this process produces a profiled surface free of all visible oil, grease, dirt, dust, metal oxides, and other foreign matter when viewed without magnification. The standard also contains unique procedures, including inspection for a passivation treatment and wet storage stain.
    b. Use for the following:
        1) Galvanized-steel items to be painted or coated, including powder coating.
    c. Acceptable alternative preparation method for galvanized items to be painted: ASTM D6386.
    d. Acceptable alternative preparation method for galvanized items to be powder-coated:ASTM D7803.

2.04 STEEL GALVANIZING

A. Galvanizing: Hot-dip galvanize steel and iron items to comply with the following:
    1. Sheet Steel: ASTM A653/A653M. Total both sides weight of coating as follows:
        a. G30 (Z90 metric): 0.30 oz/ft2.
        b. G40 (Z120 metric): 0.40 oz/ft2.
        c. G60 (Z180 metric): 0.60 oz/ft2.
        d. G90 (Z275 metric): 0.90 oz/ft2.
        e. G115 (Z350 metric): 1.15 oz/ft2.
    2. Steel and Iron Hardware: ASTM A153/A153M. Weight of coating as follows:
        a. Class A: Castings, malleable iron, and steel: 2.0 oz/ft2 minimum.
        b. Class B1: Rolled, pressed, and forged articles 5/8 inch in thickness and over 15 inches in length: 2.0 oz/ft2 minimum.
        c. Class B2: Rolled, pressed, and forged articles under 5/8 inch in thickness and over 15 inches in length: 1.5 oz/ft2 minimum.
        d. Class B3: Rolled, pressed, and forged articles, any thickness and less than 15 inches in length: 1.3 oz/ft2. minimum.
        e. Class C: Fasteners over 3/8 inch in diameter and similar, and washers 3/16 inches and greater in thickness: 1.25 oz/ft2 minimum.
        f. Class D: Fasteners 3/8 inch and under in diameter, including rivets, nails, and similar; and washers under 3/16 inch in thickness: 1.0 oz/ft2 minimum.
    3. Steel and iron products made from rolled, pressed, and forged shapes, castings, plates, bars, and strips: ASTM A153/A153M.
    4. Galvanized Steel to be Painted / Coated: Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

2.05 STEEL GALVANNEALING

A. Galvannealed Steel: Zinc-iron alloy-coated (Galvannealed) steel to comply with the following:
   1. Steel Sheet: ASTM A653/A653M. Total both sides weight of coating as follows:
      a. A25 (ZF75 metric): 0.25 oz/ft2.
      b. A40 (ZF120 metric): 0.40 oz/ft2.
      c. A60 (ZF180 metric): 0.60 oz/ft2.

2.06 GALVALUME STEEL

A. Galvalume Steel: 55 percent aluminum-zinc alloy-coated (Galvalume) steel to comply with the following:
   1. Steel Sheet: ASTM A792/A792M. Total both sides weight of coating as follows:
      a. AZ30 (AZM100 metric): 0.30 oz/ft2.
      b. AZ35 (AZM110 metric): 0.35 oz/ft2.
      c. AZ40 (AZM120 metric): 0.40 oz/ft2.
      d. AZ50 (AZM150 metric): 0.50 oz/ft2.
      e. AZ55 (AZM165 metric): 0.55 oz/ft2.
      f. AZ60 (AZM180 metric): 0.60 oz/ft2.
      g. AZ70 (AZM210 metric): 0.70 oz/ft2.

2.07 STAINLESS STEEL

A. Stainless Steel: Alloys of steel containing greater than 10 percent chromium.
   1. Standard Environments: Exterior, exposed stainless steel to be Type 304, typical unless noted otherwise.
   2. Corrosive Environments: Exterior, exposed stainless steel to be Type 316L, typical unless noted otherwise.
   3. See Section 011000 - Summary, for additional information.

B. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

C. Provide finish as specified in other Sections. Finish to align with requirements of ASTM A480/A480M:
   1. Unpolished Finishes:
      a. No. 1: Hot-rolled, annealed, and descaled.
         1) Description: Commonly referred to as hot-rolled annealed, or pickled, or descaled. This is a dull, nonreflective finish.
      b. No. 2B: Cold-rolled, bright finish.
         1) Description: A smooth, moderately reflective fold-rolled annealed and pickled or descaled finish typically produced by imparting a final light cold-rolled pass using polished rolls. This general-purpose finish is more readily polished than a No. 1 or 2D finishes.
      c. No. 2D: Cold-rolled, dull finish.
         1) A smooth, non-reflective fold-rolled, annealed, and pickled or descaled finish. This nondirectional finish is favorable for retention of lubricants in deep drawing applications.
      d. Bright annealed.
         1) Description: A smooth, bright, reflective finish typically produced by cold rolling followed by annealing in a protective atmosphere so as to prevent oxidation and scaling during annealing.
   2. Polished Finishes:
      a. No. 3: Intermediate polished finish.

1) Description: A linearly textured finish that may be produced by either mechanical polishing or rolling. Average surface roughness (Ra) can generally be up to 40 micro-inches.

b. No. 4: General purpose polished finish.
1) Description: A linearly textured finish that may be produced by either mechanical polishing or rolling. Average surface roughness (Ra) can generally be up to 25 micro-inches.

c. No. 6: Dull, satin finish, Tampico brushed.
1) Description: Soft, satin appearance typically produced by Tampico brushing a No. 4 finish.

d. No. 7: High luster finish.
1) Description: Has a high degree of reflectivity. It is produced by buffing a finely ground surface, but the grit lines are not removed.

e. No. 8: Mirror finish.
1) Description: A highly-reflective, smooth finish typically produced by polishing with successively finer grit abrasives, then buffing.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.08 WEATHERING STEEL

A. Weathering Steel: ASTM A588/A588M and ASTM A606/A606M.

2.09 ALUMINUM, GENERAL

A. Treat and finish aluminum according to the Aluminum Association Designation System AA DAF-45. Treatment and finish of aluminum components may include combinations of mechanical finishes (M##), chemical treatments and finishes (C##), and anodic coatings (A##), as defined by AA DAF-45.

B. Subject to compliance with requirements, acceptable aluminum treatment and finishing processors include:
1. ABC Aluminum Solutions.
2. Linetec.
3. Lorin.
4. Pioneer Metal Finishing.
5. Quality Coatings.
6. Sierra Aluminum Company.
7. Southern Aluminum Finishing (SAF).
8. Substitutions: See Section 01 2500 - Substitution Procedures.

2.10 ALUMINUM ANODIZING

A. Class I Anodizing: When specified in other Sections, provide anodizing treatment of aluminum as designated by AA DAF-45 and compliant with AAMA 611, Class I:
1. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.
2. Color Anodic Finish: AAMA 611, Class I, AA-M12C22A42/43/44.
a. Color: As specified in applicable Section or as selected by Architect.
3. AAMA 611, Class I Minimum Performance Requirements:
a. Film Thickness: 0.7 mils.
b. Salt Spray Resistance: 3,000 hours.
c. Color Retention: Maximum of 5 Hunter units of color change in 10 years.
d. Gloss Uniformity: 15 unit Variation.

4. Location:
    a. All exterior applications.
    b. Interior applications subject to excessive wear or abrasion.

B. Class II Anodizing: When specified in other Sections, provide anodizing treatment of aluminum as designated by AA DAF-45 and compliant with AAMA 611, Class II:
1. Clear Anodic Finish: AAAMA 611, Class II, AA-M12C22A31.
2. Color Anodic Finish: AAMA 611, Class II, AA-M12C22A32/33/34.
    a. Color: As specified in applicable Section or as selected by Architect.
3. AAMA 611, Class II Minimum Performance Requirements:
    a. Film Thickness: 0.4 mils.
    b. Salt Spray Resistance: 1,000 hours.
    c. Color Retention: Maximum of 5 Hunter units of color change in 10 years.
    d. Gloss Uniformity: 15 unit Variation.
4. Location:
    a. Interior applications not subject to excessive wear or abrasion.

2.11 STRUCTURAL STEEL SHOP PRIMING

A. See Section 051200 - Structural Steel Framing for additional information.

2.12 SHOP PRIMING FOR FIELD FINISH

A. Shop Primers: Provide primers that comply with field finish, as specified in the following Sections:
1. Section 099113 - Exterior Painting.
2. Section 099123 - Interior Painting.
3. Section 099600 - High-Performance Coatings.

B. Shop Priming: Apply shop primer to comply with SSPC-PA 1.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

2.13 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paint specified to be used over it.

PART 3 EXECUTION

3.01 REPAIR

A. Field Repair: When acceptable to manufacturer, field repair shop-applied coatings per manufacturer's instructions and materials.
1. When not acceptable, return to shop for corrections.

B. Replace items that cannot be repaired.

END OF SECTION

SECTION 050513
SHOP-APPLIED COATINGS FOR METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-applied, heat-cured coating systems for metal substrates.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting: For shop and field applied air-cured paint for steel substrates.

B. Section 099600 - High-Performance Coatings: For shop and field applied air-cured high-performance coatings for steel substrates.

1.03 DEFINITIONS

A. Coil Coating: Coating system applied in liquid form to continuous flat metal stock. The finished metal is wound into a circular coil for later fabrication by others. This is a type of pre-painting.

B. Extrusion Coating: Coating system spray-applied to extruded components, flat metal that is too thick to be coil coated (greater than 0.080 inches), and decorative metal with voids and other openings. This is a type of post-painting. Extrusion coatings can be both liquid and powder form.

C. Mica Finish: Utilizes mica, a naturally occurring mineral, which provides a pearlescent appearance. Mica powder provides better color consistency than metal flakes.

D. Metallic Finish: Utilizes metal flakes for a sparkle appearance.

E. Barrier Coat: Used in a four-coat system only, to protect the prime coat below from UV damage.

1.04 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. ASTM D523 - Standard Test Method for Specular Gloss; 2025.

E. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2022.

F. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.

G. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2023.

H. ASTM D7091 - Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals; 2022.

1.05 SUBMITTALS

A. See Section Section 01 3000 - Administrative Requirements.

B. Refer to submittals in other Sections which specify finishes in this Section.

C. Maintenance Materials: Where field repair of shop-applied coating is acceptable, provide container of material to perform minor corrective work.

D. Qualification Statement: For installer.

1.06 COORDINATION

A. Coordinate substrates and shop-applied coating systems. Where items are indicated to match coatings selected for other items, adjust formulations as required to achieve match.

1.07 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.
   1. Applicator Qualifications: Coating manufacturer's certified applicator equipped and trained for application of coatings, and approved to provide warranty specified.

1.08 DELIVERY, STORAGE & HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver, unload, and store coated items so that they remain free of damage and deformation. Package and protect items during shipping and handling. Protect stored items from water. Keep coated items out of contact with materials that may adversely affect the coating.

C. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.09 WARRANTY

A. See Section 01 6000 - Product Requirements.

B. Contractor to provide Single Source Specimen Warranty (color, chalk, and fade), as provided by Coating Manufacturer, as part of Total System Executed Warranty (corrosion, adhesion) as provided by end manufacturer for both coil and extrusion products.

C. Special Coating Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which coatings do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Superior Coatings (AAMA 2605) Warranty Period: 20 years from date of Substantial Completion.
   3. High-Performance Coatings (AAMA 2604) Warranty Period: 10 years from date of Substantial Completion.
   4. Pigmented Coatings (AAMA 2603) Warranty Period: 1 year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Coatings in this Section are divided into three performance levels, from highest to lowest, as defined by organization standards and supported by manufacturer's warranty:
   1. Superior.
   2. High-Performance.
   3. Pigmented.

B. Refer to referenced standards for additional performance requirements not listed here.

C. Superior Coatings:
   1. Warrantied Substrates:
      a. Aluminum extrusions (AAMA 2605).
      b. Aluminum coil (AAMA 2605 Appendix).
      c. Galvanized steel coil (AAMA 2605).
   2. Minimum Performance Requirements:
      a. Test Duration: 4,000 hours.
      b. Dry Film Thickness (ASTM D7091): 1.2 mils minimum.
      c. Abrasion Resistance (ASTM D968): Coefficient of 40 minimum.
      d. Color Retention (ASTM D2244): Maximum of 5 Hunter units of color change.
      e. Chalk Resistance (ASTM D4214): No more than No. 8 rating for color, No. 6 rating for whites, after 10 years.
      f. Gloss Retention (ASTM D523): More than 50 percent retention after 10 years.

D. High-Performance Coatings:
   1. Warrantied Substrates:
      a. Aluminum extrusions (AAMA 2604).
      b. Aluminum coil (AAMA 2604 Appendix).
   2. Minimum Performance Requirements:
      a. Test Duration: 3,000 hours.
      b. Dry Film Thickness (ASTM D7091): 1.2 mils minimum.
      c. Abrasion Resistance (ASTM D968): Coefficient of 20 minimum.
      d. Color Retention (ASTM D2244): Maximum of 5 Hunter units of color change.
      e. Chalk Resistance (ASTM D4214): No more than No. 8 rating for color after 5 years.
      f. Gloss Retention (ASTM D523): Minimum 30 percent retention after 5 years.

E. Pigmented Coatings:
   1. Warrantied Substrates:
      a. Aluminum extrusions (AAMA 2603).
      b. Aluminum coil (AAMA 2603 Appendix).
   2. Minimum Performance Requirements:
      a. Test Duration: 1,500 hours.
      b. Dry Film Thickness (ASTM D7091): 0.8 mils minimum.
      c. Color Retention (ASTM D2244): Slight change allowed.
      d. Chalk Resistance (ASTM D4214): Slight change allowed.
      e. Gloss Retention (ASTM D523): Slight change allowed.

2.02 MANUFACTURERS

A. Manufacturers:
   1. AkzoNobel.
   2. Sherwin Williams (formerly Valspar).

3. PPG.
4. Substitutions: See Section 01 2500 - Substitution Procedures.

B. Single Source: For each coating system, provide all components of system from same manufacturer.

2.03 SHOP-APPLIED COATINGS, GENERAL

A. Comply with coating manufacturer's written instructions for cleaning, conversion coating, applying, and baking finish.

B. UV-Stable Primers: For finish coats that are transparent, translucent, iridescent, and metallic, provide UV-stable primer to protect coating system integrity.

C. Gloss: As selected by Architect from manufacturer's range for specific system, typical.

D. Clear coat: Optional protection to color coat, except for metallic flake or as another barrier coat that can easily be rinsed with fresh water to eliminate salt residue or used to improve chalk and fade resistance.

2.04 SUPERIOR COATINGS (AAMA 2605)

A. 70 percent PVDF Fluoropolymer, Two-Coat: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
   1. System Components: Primer and PVDF color coat.
   2. Extrusion Products:
      a. AkzoNobel; Trinar Ultra.
      b. PPG; Duranar.
      c. Sherwin Williams; Fluropon.
   3. Coil Products:
      a. AkzoNobel; Trinar Ultra.
      b. PPG; Duranar.
      c. Sherwin Williams; Fluropon.
   4. Basis of Design Colors:
      a.
   5. Gloss: As selected from manufacturer's full range.

B. 70 percent PVDF Mica Fluoropolymer, Two-Coat: Fluoropolymer finish with suspended mica, and containing not less than 70 percent PVDF resin by weight in color coat.
   1. System Components: Primer, PVDF color coat with mica.
   2. Extrusion Products:
      a. AkzoNobel; Tri-Escent II.
      b. PPG; Duranar Sunstorm.
      c. Sherwin Williams; Fluropon Classic II.
   3. Coil Products:
      a. AkzoNobel; Tri-Escent II.
      b. PPG; Duranar Sunstorm.
      c. Sherwin Williams; Fluropon Classic II.
   4. Basis of Design Colors:
      a.
   5. Gloss: As selected from manufacturer's full range.

C. 70 percent PVDF Metallic Fluoropolymer, Three-Coat: Fluoropolymer finish with suspended metallic flakes, and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
   1. System Components: Primer, PVDF color coat with metallic flakes, and PVDF clear coat.
   2. Extrusion Products:

a. AkzoNobel; Trinar TMC.
b. PPG; Duranar XL Metallic.
c. Sherwin Williams; Fluropon Classic.

3. Coil Products:
a. AkzoNobel; Trinar TMC.
b. PPG; Duranar XL Metallic.
c. Sherwin Williams; Fluropon Classic.

4. Basis of Design Colors:
a.

5. Gloss: As selected from manufacturer's full range.

D. Powder Coating, One-Coat: Fluoropolymer finish containing resin and solar-reflective, metal-oxide pigments.
1. System Components: Color coat.
2. Extrusion Products:
a. AkzoNobel; Interpon D3000.
b. PPG; Coraflon Powder.
c. Sherwin Williams; Powdura OneCure.
3. Basis of Design Colors:
a.
4. Gloss: As selected from manufacturer's full range.

E. Powder Coating, Mica, One-Coat: Fluoropolymer finish containing resin with suspended mica, and solar-reflective metal-oxide pigments.
1. System Components: Color coat with mica.
2. Extrusion Products:
a. AkzoNobel; Interpon D3000.
b. PPG, Coraflon Sunstorm Powder.
3. Basis of Design Colors:
a.
4. Gloss: As selected from manufacturer's full range.

2.05 HIGH-PERFORMANCE COATINGS (AAMA 2604)

A. 50 percent PVDF Fluoropolymer, Two-Coat: Fluoropolymer finish containing not less than 50 percent PVDF resin by weight in color coat.
1. System Components: Primer and PVDF color coat.
2. Extrusion Products:
a. AkzoNobel; Alum-A-Star 50.
b. PPG; Acrynar.
c. Sherwin Williams; Acroflur.
3. Basis of Design Colors:
a.
4. Gloss: As selected from manufacturer's full range.
5. Locations:
a. Interior exposed aluminum for aluminum framing systems.

2.06 FIELD TOUCH-UP MATERIAL

A. Field Touch-Up Material: Field-applied, air-dry system recommended by coating manufacturer for substrate and location.

2.07 FACTORY AND SHOP FINISHING

A. Pretreatment: Mechanically clean and chemically pre-treat fabricated items in accordance with coating manufacturer's requirements and AAMA requirements for finish indicated.

B. Apply primer and finish coats in accordance with coating manufacturer's requirements for finish indicated.

C. Thermally cure coating immediately following application.

D. Process coil coatings in one production run for metallic coatings.

E. Surface Appearance: Cured coating must be visibly free from flowlines, streaks, blisters and other surface imperfections on exposed surfaces.
   1. Surfaces shall have no signs of mill finish aluminum or galvanized material showing.
   2. No rack or gripper marks caused by the finishing process on exposed aluminum surfaces will be permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. See Section 01 7000 - Execution and Closeout Requirements.

B. Examine finished metal products to confirm no damage has occurred.
   1. Damaged products that cannot be fixed by field touch-up, to the satisfaction of the Architect, will be rejected.

3.02 REPAIR AND TOUCH-UP

A. Repair with coating manufacturer's recommended products or system.

B. Apply to all minor areas of exposed metal due to scratches, abrasions, in-field end cuts or of the like typically occurring during transit or installation of product, to ensure protection of the metal substrate.

3.03 PROTECTION

A. See Section 01 7000 - Execution and Closeout Requirements.

B. Provide barrier or other delineation to prevent damage to installed Work from subsequent construction activities.

END OF SECTION

SECTION 051200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel .

C. Base plates, shear stud connectors and expansion joint plates.

D. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 014113.11 - Regulatory Requirements - Global Warming Potential (GWP)

B. Section 031000 - Concrete Forming and Accessories.

C. Section 033000 - Cast-in-Place Concrete.

D. Section : Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

E. Section 052100 - Steel Joist Framing.

F. Section 053100 - Steel Decking: Support framing for small openings in deck.

G. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

A. The applicable version of the standards listed below shall be per Chapter 35 of Part 2 of the 2022 edition of the California Building Code (CBC), including addendums and errata. Where the standard is not listed, then the most current version of the standard shall be used or as referenced by other standards.

1. AISC (MAN) - Steel Construction Manual.
2. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.
3. AISC 341 - Seismic Provisions for Structural Steel Buildings.
4. AISC 360 - Specification for Structural Steel Buildings.
5. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
6. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
7. ASTM A108 - Standard Specification for Steel Bar, Carbon, and Alloy, Cold Finished.
8. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
9. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
10. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel.
11. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
12. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
13. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

14. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
15. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
16. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric].
17. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
18. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
19. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
20. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
21. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
22. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film.
23. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.
24. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry.
25. ASTM E709 - Standard Guide for Magnetic Particle Testing.
26. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
27. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
28. ASTM E94 - Standard Guide for Radiographic Examination.
29. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series.
30. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
31. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
32. AWS D1.1/D1.1M - Structural Welding Code - Steel.
33. AWS D1.4/D1.4M – Structural Welding Code - Reinforcing Steel.
34. AWS D1.8/D1.8M - Structural Welding Code - Seismic Supplement.
35. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.
36. SSPC SP-1 - Solvent Cleaning.
37. SSPC SP-2 - Hand Tool Cleaning.
38. SSPC SP 3 - Power Tool Cleaning.

B. California Code of Regulations (CCR):
   1. CBSC, Title 24, Part 2- California Building Code (CBC) 2022 edition.
      a. Chapter 17 - Structural Tests and Inspections.
      b. Chapter 22 - Steel.
   2. CBSC, Title 24, Part 11 - California Green Building Standards Code (CALGreen)
      a. Supplement 1, July 2024

C. ICC Evaluation Service, Inc. (ICC ES), a subsidiary corporation of the International Code Council:
   1. ICC ES Evaluation Reports, Materials, Products, Methods and Types of Construction, with current report (ESR).

D. International Association of Plumbing and Mechanical Officials (IAPMO):

1. UES Evaluation Service Reports (IAMPO R&T).

E. Research Council on Structural Connections
1. Specification for Structural Joints Using High-Strength Bolts.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
a. Individual items of structural steel shall be cross-referenced by grid location.
2. Indicate cambers.
3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths. Indicate shop or field welds.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
1. Submit Charpy-V-Notch (CVN) Impact Test results from the manufacturer for applicable steel members and components.

D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

E. Fabricator Test Reports: Comply with ASTM A1011/A1011M.

F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

G. Fabricator's Qualification Statement.

H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172 or AISC Certified Fabricator.

I. Welding Procedures:
1. Submit welding procedures, indicating joint details and tolerances, preheat and interpass temperature, post heat treatment, single or multiple pass, electrode type and size, welding current, polarity, and amperes and roof treatment.
a. Project CWI shall review WPS and PQRs prior to submittal to the Architect.
2. Welding procedures shall comply with the requirements of AWS D1.1 and D1.8, and it shall include the welding parameters recommended by the welding electrode manufacturer.
3. Refer to Structural Contract Drawings for weld testing and inspection.
4. Submit Charpy-V-Notch (CVN) Impact Test results from the manufacturer for applicable welds.

J. Sustainable Design Submittals
1. Type III factory-specific or product-specific environmental product declarations (EPD) for each of the following products:
a. Hot Rolled Structural Steel
b. Hollow Structural Steel
c. Steel Plate
2. Materials & Resources Submittals: Refer to Section 018113 for additional information on LEED submittals.
a. Letter Template for MR Credit 2.1 and Credit 2.2: Letter template, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
1) Comply with Section 017419 Construction Waste Management and Disposal.

b. Product Data and Certification Letter for MR Credit 4.1 and MR Credit 4.2: Indicate percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
c. Product Data for MR Credit 5.1 and MR Credit 5.2: For regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual and AISC 303 - Code of Standard Practice.
B. Structural steel members designated as architecturally-exposed structural steel (AESS) to also comply with Section .
C. Fabricator: Company specializing in performing the work of this section with minimum 5 years of documented experience.
D. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172 or Certified by AISC or City of Los Angeles.
E. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.
    1. Licensed, certified by AISC or City of Los Angeles, and approved in writing by the accepted fabricator.

1.06 DELIVERY, STORAGE, AND HANDLING

A. A. Storage: Protect steel members that will be stored on site for a prolonged period to protect from adverse effects of exposure to weather.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles and Channels: As specified in contract drawings.
B. Steel W Shapes and Tees: As specified in contract drawings.
C. Rolled Steel Structural Shapes: As specified in contract drawings.
D. Steel Plates: As specified in contract drawings.
E. Cold-Formed Structural Tubing: As specified in contract drawings
F. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.
G. Pipe: As specified in contract drawings.
H. Shear Stud Connectors: As specified in contract drawings.
I. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.
J. High-Strength Structural Bolts, Nuts, and Washers: As specified in contract drawings.
K. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.
L. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at connections requiring high-strength bolts.

M. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

N. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength as indicated in structural drawings.
   2. Minimum Compressive Strength at 28 Days: 8,000 pounds per square inch.

O. Adhesive Anchoring Systems: As indicated in contract drawings.

P. Mechanical Anchors: As indicated in contract drawings.

Q. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

R. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

S. Global Warming Potential (GWP) Limits:
   1. Hot Rolled Structural Steel: as indicated on the drawings
   2. Hollow Structural Steel: as indicated on the drawings
   3. Steel Plate: as indicated on the drawings.

2.02 FABRICATION

A. Fabricate structural steel in accordance with the AISC Specification and CBC Chapter 22. Do not start fabrication until mill test reports have been accepted by Architect.

B. Shop fabricate to greatest extent possible.

C. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

D. Holes shall be standard hole diameter, unless noted otherwise.
   1. Holes for anchor bolts cast in concrete may be oversized in accordance with AISC Manual. Provide washer as indicated.

E. Welded Connections: Refer to Structural Contract Drawings for welding requirements.
   1. Make welded connections in accordance with AWS D1.1/D1.1M and AWS D1.8/D1.8M.

F. Headed Welded Studs: Prepare steel surfaces as recommended by the manufacturer of the shear connectors. Shop or field-weld headed welded studs, spaced as indicated, to beams and columns. Use automatic end welding of headed stud shear connectors in accordance with the manufacturer's printed instructions. Provide complete fusion between end of the stud and the member without porosity or evidence of lack of fusion.

G. Galvanizing: Hot dip galvanize ferrous metal in accordance with ASTM A 123. Hot dip galvanize exterior ferrous steel. Perform galvanizing after fabrication (shearing, punching, bending, forming, assembling, and welding) in the largest units practicable. Remove projections, barbs, and icicles after galvanizing.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

C. Prepare and paint steel as indicated in contract drawings and in conformance with 099100 - Painting and 099713 - High Performance Steel Coatings

2.04 SOURCE QUALITY CONTROL

A. No structural steel materials may be used, fabricated, or furnished until written acceptance of quality control submittals is issued by the code enforcement agency.

1. Conduct a thorough material ID and mill certification review for steel products.
2. Provide identifiable steel per CBC 2202A.
    a. Unidentifiable steel shall not be permitted for use.

B. Conform to the inspection requirements of CBC Chapter 17 and the testing requirements of CBC 2204 2204:
    1. Special inspection of Structural Welding and bolting shall be per CBC 1705.2.
        a. Inspection of shop and field welding operations shall be made by a qualified welding inspector approved by the enforcement agency. The minimum requirements for a qualified welding inspector shall be as those for an AWS certified welding inspector (CWI), as defined in the provisions of the AWS QC1. All welding inspectors shall be as approved by the enforcement agency.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303 and AISC 360.

B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
    1. Level and plumb individual members of structure within specified AISC tolerances.

C. Splice members only where indicated and accepted on final shop drawings.

D. Do not enlarge holes in members by burning or by use of drift pins except in secondary bracing members. Ream holes that must be enlarged to accept bolts.

E. Back-up bars, dams, and runoff tabs shall be removed: the weld, base metal shall be ground flush and smooth per AWS.

F. High-Strength Steel Bolting: Perform in accordance with the AISC 303, AISC 36, and in accordance ICC (IBC)-2018 Chapter 22.
    1. Materials, method of installation and tension control, type of wrenches to be used, and inspection methods shall conform to ASTM F3125.

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

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

I. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

A. Steel members and erection shall conform with requirements of AISC 303 and AISC 360.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

END OF SECTION

SECTION 051213
ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL (AESS) FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

1.02 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: General requirements for structural steel members, including AESS framing specified in this section.

B. Section 052100 - Steel Joist Framing: Alignment and location of bridging where joists are visible.

C. Section 053100 - Steel Decking: Erection requirements relating to exposed steel decking and its connections.

D. Section 099600 - High-Performance Coatings: Finish coat requirements and coordination with primer and surface preparation specified in this section.

1.03 DEFINITIONS

A. Architecturally-Exposed Structural Steel: Structural steel complying with designated AESS category as defined in AISC 303.

1.04 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022.

B. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2025).

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2023.

D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

E. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS); 2015.

F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

I. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

J. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting at project site minimum 2 weeks prior to start of work of this section; require attendance by all affected installers. Coordinate requirements for shipping, special handling, storage, attachment of safety cables and temporary erection bracing, final coating, touch-up painting, mock-up coordination, Architect's observations, and other requirements for AESS.
   1. See Section Section 01 3000 - Administrative Requirements, for additional information.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Detailing for fabrication of AESS components.
   1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.
   2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.
   3. Indicate welds by AWS A2.4 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 by the designated AESS category.
   4. Indicate orientation of hollow structural section (HSS) seams and mill marks (where applicable).
   5. 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. Indicate orientation of bolt heads.
   6. Indicate which surfaces or edges are exposed and what class of surface preparation is being used.
   7. Indicate special tolerances and erection requirements as noted on drawings or defined by the designated AESS category.
   8. Indicate vent or drainage holes for HSS members.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Qualification data for fabricator and erector to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, photographs showing detail of installed AESS, and other information specified.

1.07 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.

B. Fabricator Qualifications: In addition to those qualifications listed in Section 051200, engage an AISC Certified Fabricator, 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.

C. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work..

D. Comply with applicable provisions of AISC 303, Section 10 for the designated AESS category.

1.08 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Notify Architect one week in advance of dates and times when mock-ups will be available for review.

C. Demonstrate applicable AESS characteristics for specified category of AESS on elements and joints in mock-up.

D. Build mock-ups using member sizes and materials indicated for final work.

E. Mock-up to demonstrate weld quality, contouring of welds at aligned walls of members, specified surface preparation, and finish coating.

F. Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging completed work.

G. Approved mock-ups in an undisturbed condition at Date of Substantial Completion may become part of completed work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.

C. 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.

D. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Comply with Section 051200, except as amended in this section for aesthetic purposes.

2.02 FABRICATION

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

B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.

C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

D. Fabricate AESS in accordance with categories defined in AISC 303, as follows:
   1. AESS 1: Basic elements.
   2. AESS 2: Feature elements viewed at a distance greater than 20 feet (feature elements not in close view).
   3. AESS 3: Feature elements viewed at a distance less than 20 feet (feature elements in close view).
   4. AESS 4: Showcase elements with special surface and edge treatment beyond fabrication (showcase elements).

2.03 PAINT SYSTEM

A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Sections 099600. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.

2.04 SHOP PRIMING

A. Surface Preparation:
   1. Comply with SSPC-SP 6/NACE No.3.
   2. Coordinate required surface profile with approved paint submittal prior to beginning surface preparation.
   3. Prior to blasting, remove any grease and oil using solvent cleaning to meet SSPC-SP 1.
   4. Remove weld spatter, slivers and similar surface discontinuities.
   5. Ease sharp corners resulting from shearing, flame cutting or grinding.

B. 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Erector to check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of 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 approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.

B. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

3.03 ERECTION

A. AESS 1 and 2: Basic elements; feature elements not in close view:
   1. Employ special care to handle and erect AESS. Erect finished pieces using nylon straps or chains with softeners such that they are not damaged.
   2. Place weld tabs for temporary bracing and safety cabling at points concealed from view in completed structure or where approved by Architect during pre-installation meeting. Obtain Architect approval of methods for removing temporary devices and finishing AESS members prior to erection.
   3. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of AISC 303.
   4. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

5. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
6. Remove all backing and run out tabs.
7. When temporary braces or fixtures are required to facilitate erection, take care to avoid any blemishes, holes or unsightly surfaces resulting from use or removal of such temporary elements.
8. Bolted Connections: Align bolt heads on same side of connection as indicated on approved fabrication or erection documents.
9. Welded Connections: Comply with AWS D1.1/D1.1M and Section 051200. Appearance and quality of welds to be consistent. Employ methods that will maintain alignment of members without warp exceeding tolerance of this section.
10. Remove weld spatter exposed to view.
11. Grind off projections larger than 1/16 inch at field butt and plug welds.
12. Continuous Welds: Where continuous welding is noted on drawings, provide continuous welds of a uniform size and profile.
13. Do not enlarge 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 final appearance.
14. Splice members only where indicated.
15. Obtain permission for any torch cutting or field fabrication from Architect. Finish sections thermally cut during erection to a surface appearance consistent with mock-up.

B. AESS 3: Feature elements in close view:
1. Erect to requirements of AESS 1 and 2 and as follows:
2. Field Welding: Weld profile, quality, and finish to be consistent with mock-ups approved prior to fabrication.
3. Provide a continuous appearance to all welded joints including tack welds. Provide joint filler at intermittent welds.

C. AESS 4: Showcase elements:
1. Erect to requirements of AESS 3 and as follows:
2. Grind welds smooth.
3. Minimize Weld Show Through: At locations where welding on far side of an exposed connection creates distortion, grind distortion and marking of steel to a smooth profile with adjacent material.
4. Filling of Weld Access Holes: Where holes must be cut in web at intersection with flanges on W shapes and structural tees to permit field welding of flanges, fill holes with joint filler.
5. 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.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Structural Requirements:
1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 051200 for additional requirements.
2. Quality assurance agency to review work for compliance with requirements of AISC 360, Chapter N and AISC 303, Section 10.

C. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.05 CLEANING

A. Touch-up Painting: Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 099600.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.
B. Slotted channel framing.
C. Abrasive metal nosings.

1.02 REFERENCE STANDARDS

A. ASTM A1 - Standard Specification for Carbon Steel Tee Rails; 2000 (Reapproved 2018).
B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.
F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
G. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2021.
H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.
I. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
K. ASTM A1018/A1018M - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018.
L. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.
M. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.
N. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.
O. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings; 2018, with Editorial Revision.
P. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
Q. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

R. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

T. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

U. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019, with Editorial Revision (2025).

V. MFMA-4 - Metal Framing Standards Publication; 2004.

W. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

X. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. Recycled content data.

C. Delegated Design Documents: See Section 01 3000 - Administrative Requirements.
   1. Provide design documentation prepared by Contractor's Licensed Professionals.

D. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
      a. Include the following, as applicable:
         1) Design criteria.
         2) Engineering analysis depicting stresses.
         3) Member sizes and gauges.
         4) Details of connections.
         5) Support reactions.
         6) Bracing requirements.

E. Designer's Qualification Statement.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.04 QUALITY ASSURANCE

A. Design metal fabrications under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 DELEGATED DESIGN

A. Delegated Design: See Section 01 3000 - Administrative Requirements.

B. Engage a qualified professional engineer, as defined in Section 01 4000 - Quality Requirements, to design fabricated metal items.

2.02 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.03 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Stainless Steel, General: ASTM A666/A666M, Type 304.

F. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch minimum metal thickness, 1-1/2 inch diameter.

G. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

H. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.04 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.

F. Aluminum-Alloy Die Castings: ASTM B85/B85M.

G. Bolts, Nuts, and Washers: Stainless steel.

H. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.05 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.06 FABRICATED ITEMS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
   1. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

B. Loose Bearing and Leveling Plates: For steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; high-performance coating finish.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

E. Lintels: As detailed; galvanized finish.

F. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.

G. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

H. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

2.07 SLOTTED CHANNEL FRAMING

A. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Manufacturers:
      a. ABB Installation Products.
      b. Eaton.
      c. Flex-Strut.
      d. Unistrut (Atkore International).
      e. Wesanco (ZSI-Foster).
      f. Substitutions: See Section 01 2500 - Substitution Procedures.
   2. Physical Properties:
      a. Size, Thickness,and Configuration: As indicated, or as otherwise required to support loads.
      b. Material:
         1) Stainless Steel: ASTM A1011/A1011M SS, Grade 33 cold formed steel struts.
            (a) Fittings: ASTM A1018/A1018M SS, Grade 33 steel.
            (b) Hardware AISI Type 304 stainless steel.
         2) Galvanized Steel: ASTM A653/A653M, commercial steel Type B or structural steel Grade 33 (Grade 230), with G90 coating.
      c. Closure Strips: Manufacturer's standard snap-in product to close exposed channel openings.
      d. Framing channels and fittings shall have the manufacturers name, part number, and material heat code identification number stamped in the part itself for identification.

2.08 ABRASIVE METAL NOSINGS

A. Manufacturers:
   1. American Safety Tread.
   2. Amstep Products.

3. Balco.
4. Granger.
5. Grating Pacific.
6. Nystrom.
7. Wooster Products.
8. Substitutions: See Section 01 2500 - Substitution Procedures.

B. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder.
   1. Apply clear lacquer to concealed surfaces.

C. Cast Units: Cast iron, aluminum, bronze, or nickel silver, with an integral abrasive as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both.
   1. Apply bituminous paint to concealed surfaces.

D. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

E. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches from ends and not more than 12 inches on center.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

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

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 055213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Free-standing railings at exterior step and ramps.

1.02 RELATED REQUIREMENTS

A. Section 321313 - Concrete Paving.

1.03 REFERENCE STANDARDS

A. AISC 207 - Standard for Certification Programs; 2025.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

H. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each item to be installed

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. CAL (CDPH SM) compliance data.
   3. Recycled content data.

D. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's seal and signature on each sheet of shop drawings.

E. Designer's Qualification Statement.

F. Fabricator's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.

B. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

C. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 207.
   2. A company specializing in manufacturing products specified in this section, with not less than years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver materials in factory-provided protective coverings and packaging.

C. Protect materials against damage during transit, delivery, storage, and installation at site.

D. Inspect materials upon delivery for damage. Replace damaged items.

E. Prior to installation, store materials and components under cover in dry location.

F. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.07 FIELD CONDITIONS

A. Ambient Conditions:
   1. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F and maximum 95 degrees F.
   2. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after railing installation.

B. Field Measurements: Verify actual dimensions by field measurement before fabrication. Show recorded measurements on shop drawings.

1.08 WARRANTY

A. See Section 01 6000 - Product Requirements and Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's standard warranty for each product.

PART 2 PRODUCTS

2.01 DELEGATED DESIGN

A. Delegated Design: See Section 01 3000 - Administrative Requirements.

B. Engage a qualified professional engineer, as defined in Section 01 4000 - Quality Requirements, to design pipe and tube railings.

2.02 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

D. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
         1) Concentrated load of 200 lbf applied in any direction.
         2) Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
         1) Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.04 REGULATORY REQUIREMENTS

A. California:
   1. Railings and handrails to comply with CBC Section 11B-505:
      a. Top of gripping surfaces of handrails shall be 34 inches minimum and 38 inches maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above such surfaces.
      b. Clearance between handrail griping surfaces and adjacent surfaces shall be 1-1/2 inches minimum. Handrail may be located in a recess if the recess is 3 inches maximum deep and 18 inches minmum 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 griping surfaces shall not be obstructed for more than 20 percent of their length. Where provided, horizontal projections shall occur 1-1/2 inches 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 inches minimum and 2 inches maximum.
      e. Handrail gripping surfaces with a non-circular cross section shall have an outside dimension of 4 inches minimum and 6-1/4 inches maximum, and a cross-sectional dimension of 2-1/4 inches 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 continouous handrails at the inside turn of switchback or dogleg stairs and ramps.
      i. 2 inches minimum high curb or a barrier shall be provided to prevent the passage of a 4 inches diameter sphere rolling off the sides of a ramp surface. Such a curb or a barrier shall be continuous and uninterrupted along the length of a ramp. CBC Section 11B-405.9.2.

2.05 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See drawings for configurations and heights.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

E. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.06 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. Galvanizing: In accordance with requirements of ASTM A123/A123M. See Section 050511 - Surface Preparation and Finishing of Metals, for additional information.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

G. Finish:
   1. Galvanized as noted in 2.06.E.

2.07 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by continuous welds.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.
   5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.
B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
C. Anchor railings securely to structure.
D. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.
C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 057000
DECORATIVE METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative metal, including:
   1. Decorative metal panels.
   2. Decorative metal grilles.
   3. Decorative metal reveal trim.
   4. Decorative metal mesh.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: For standard, non-decorative metal components and fabrications.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2024.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

H. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025.

L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

N. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

O. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

P. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Schedule and conduct preinstallation meeting minimum two week before starting work of this section.
   1. See Section 01 3000 - Administrative Requirements.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each item to be installed. Submit manufacturer's product data including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. CAL (CDPH SM) compliance data.
   3. Life cycle data.
   4. Recycled content data.

D. Shop Drawings: Show fabrication and installation details for decorative metal. Indicate elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

E. Sample: For each decorative metal component, in manufacturer's standard size.

F. Manufacturer's installation instructions.

G. Fabricator's qualification statement.

H. Welders' qualification statement.

I. Maintenance Data: Manufacturer's instructions for care and cleaning.

J. Executed warranty.

1.06 COORDINATION

A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating products specified in this section with not less than 5 years of documented experience.

B. Installer Qualifications:
   1. Installation by fabricator.

C. Welder Qualifications: Welding processes and welding operators certified in accordance with AWS B2.1/B2.1M no more than 12 months before start of scheduled welding work.

1.08 MOCK-UPS

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

C. Provide mock-up of specified decorative metal.

D. Locate where directed by Architect.

E. Mock-up may remain as part of work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

C. Deliver materials in factory-provided protective coverings and packaging.

D. Protect materials against damage during transit, delivery, storage, and installation at site.

E. Inspect materials for damage upon delivery. Replace damaged and unrepairable materials. Ensure replacement materials are indistinguishable from undamaged parts and finishes.

F. Prior to installation, store materials and components under cover in a dry location.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions by field measurement before fabrication. Show recorded measurements on shop drawings.

B. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after installation.

1.11 WARRANTY

A. See Section 01 6000 - Product Requirements and Section 01 6000 - Product Requirements, for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for defects in materials, fabrication, finishes, and installation. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM).

D. Life Cycle: Products in this section to have LCA as specified in Section 016000.

E. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.02 FABRICATORS

A. Decorative Metal Fabricators:

1. Bok Modern.
2. Chemetal.
3. Hendrick Architectural.
4. McNichols.
5. Moz.
6. Southern Aluminum Finishing (SAF).
7. Substitutions: See Section 01 2500 - Substitution Procedures.

2.03 DECORATIVE METAL PANELS

A. Decorative Metal Panels:
   1. Products: See Finish Schedule on the Architectural drawings.
      a. Substitutions: See Section 01 2500 - Substitution Procedures.
   2. Basis of Design Product:
      a. .
      b. Substitutions: See Section 01 2500 - Substitution Procedures.
   3. Material: Galvanized steel.
      a. Thickness: 0.050 inch.
      b. Alloy:
      c. Steel Finish: Painted, see 099113 - Exterior Painting.
      d. Galvanized Steel Finish: Painted, see 099113 - Exterior Painting.
      e. Stainless Steel Finish: No. 2B.
      f. Color and Gloss: As selected by Architect from fabricator's full range.
   4. Material: Aluminum.
      a. Thickness: 0.063 inch.
      b. Alloy:
      c. Aluminum Finish: Painted, see 099113 - Exterior Painting.
   5. Modifications:
      a. Perforations:
         1) Shape: Round.
         2) Shape Diameter:
         3) Shape Alignment: Grid.
      b. CNC-Perforations: One or more perforation shapes and sizes, with custom alignment.
         1) Shape: Round.
         2) Shape Diameter:
         3) Shape Pattern: Design provided by Architect.
      c. Cut by waterjet, laser, or plasma:
         1) Shape: Circular.
         2) Pattern: Design provided by Architect.
      d. Textured (embossed):
         1) Texture:
      e. Blasted:
         1) Blast Medium: Fine glass bead.
      f. CNC-Milled:
         1) Shape:
         2) Routing Depth:
         3) Pattern: Design provided by Architect.
   6. Custom Graphic Finish:
   7. Location:

2.04 DECORATIVE METAL GRILLES

A. Decorative Grilles for Windows:
   1. Base Metal: Aluminum.
   2. Profile: As indicated on drawings.

2.05 DECORATIVE METAL REVEAL TRIM

A. Reveal Trim:
   1. Base Metal: Aluminum.
   2. Profile: As indicated on drawings.
   3. Special Shapes: Provide U-bead trim at exposed edges.

2.06 DECORATIVE METAL MESH

A. Manufacturers:
   1. Banker Wire.
   2. Cambridge Architectural Mesh.
   3. Cascade Architectural.
   4. GKD Metal Fabrics.
   5. McNichols.
   6. Substitutions: See Section 01 2500 - Substitution Procedures.

B. Decorative Metal Mesh:
   1. Products: See Finish Schedule on the Architectural drawings.
      a. Substitutions: See Section 01 2500 - Substitution Procedures.
   2. Basis of Design Product:
      a. .
      b. Substitutions: See Section 01 2500 - Substitution Procedures.
   3. Type: Expanded, sheet metal cut and stretched.
   4. Type: Woven, metal strands woven into continuous fabric.
      a. Weave:
   5. Type: Rigid, metal strands crimped or welded.
   6. Material: Aluminum.
   7. Material Shape: Round wire.
   8. Edge: None.
   9. Finish:
      a. Color:
   10. Percent Open Area:
   11. Percent Visible Light Transmittance:
   12. Percent Visible Light Reflectance:
   13. Solar Heat Gain Coefficient:

2.07 MATERIALS

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections exposed to view on finished units.

B. Aluminum Components: ASTM B221 or ASTM B221M.
   1. Tubes: Schedule 40 pipe.
   2. Extruded Aluminum: ASTM B221 or ASTM B221M, 6063 alloy, T6 temper.
   3. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.
   4. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.
   5. Welding Materials: Comply with AWS D1.2/D1.2M.

C. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
   2. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
      a. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
      b. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
   3. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.
   4. Welding Materials: Comply with AWS D1.1/D1.1M.

D. Stainless Steel Components:
   1. Section, Plates: ASTM A666/A666M, Type 304.
   2. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
   3. Welding Materials: Comply with AWS D1.6/D1.6M.

2.08 FABRICATION

A. Fit and shop assemble items in largest practical sections for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.09 FINISHES

A. General: Comply with NAAMM AMP 500-06.
   1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions, and surface blemishes to match sheet.
   2. Protect mechanical finishes on exposed surfaces from damage.
   3. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
   4. Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

B. Anodized Finish: See Section 050511 - Surface Preparation and Finishing of Metals, for additional information.

C. Galvanized Finish: See Section 050511 - Surface Preparation and Finishing of Metals, for additional information.

D. Stainless Steel Finish: See 050511 - Surface Preparation and Finishing of Metals.

E. Shop-Applied Coating Finish: See Section 050513 - Shop-Applied Coatings for Metal, for additional information.

2.10 ACCESSORIES

A. Anchors and Fasteners: Provide anchors, fasteners, and other attachment devices required to attach to structure. Ensure attachment devices are of same material as components unless indicated otherwise.
   1. Steel Fasteners: ASTM F3125/F3125M, Type 1, galvanized in accordance with ASTM A153/A153M.
   2. Stainless Steel Fasteners: Type 304.

B. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 0.015 inch dry film thickness per coat.

C. Finish Touch-Up Materials: As recommended by manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

3.02 PREPARATION

A. Protect existing work.

B. Clean surfaces to receive units. Remove materials and substances detrimental to installation.

3.03 INSTALLATION

A. Install according to manufacturer's written instructions, and approved shop drawings.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.
   5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove protective film from exposed metal surfaces.

C. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

3.05 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.

1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 057300
DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative metal railing systems.

B. Windscreen system.

1.02 RELATED REQUIREMENTS

A. Section 014113.11 - Regulatory Requirements - Global Warming Potential (GWP).

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

F. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

H. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2021.

I. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods; 2023.

J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

K. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

L. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

O. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

P. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

Q. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2024.

R. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025.

S. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

T. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

U. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

V. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

W. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

X. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers; 2017.

Y. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Z. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Delegated Design Documents: See Section 011000 - Summary and Section 01 3000 - Administrative Requirements.
   1. Provide design documentation prepared by Contractor's Licensed Professionals.

C. Global Warming Potential (GWP): Environmental product declaration (EPD) to identify GWP less than or equal to maximum allowable value. See 014113.11 - Regulatory Requirements - Global Warming Potential (GWP), for additional information.

D. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

E. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. CAL (CDPH SM) compliance data.
   3. Life cycle data.
   4. Recycled content data.

F. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include design engineer's seal and signature on each sheet of shop drawings.

G. Samples: Submit one of each item below for each type and condition shown.
   1. Glass: 12 by 12 inches, showing color, thickness, and edge condition.
   2. Railing: 12-inch long section of each railing member, including top rails and posts; show color, finish, and connection details.
   3. Cladding: 6- by 6-inch sample of each type of cladding, showing finish.
   4. Cable Infill: 12-inch long section, including fittings.

H. Test Reports: Submit test reports from independent testing agency showing compliance with specified design and performance requirements.
I. Manufacturer's installation instructions.
J. Designer's qualification statement.
K. Manufacturer's qualification statement.
L. Installer's qualification statement.
M. Field Quality Control Reports: As specified in Part 3 of this Section.
N. Maintenance Data: Manufacturer's instructions for care and cleaning.
O. Specimen warranty.
P. Executed warranty.

1.05 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.
   1. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located or personnel under direct supervision of engineer.
   2. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 5 years of documented experience.
   3. Installer Qualifications: Installation by manufacturer, or company specializing in performing work of type specified and with at least three years of documented experience and approved by manufacturer.
B. Preinstallation Meetings: See Section 01 3000 - Administrative Requirements.
   1. Convene minimum 2 weeks before starting work of this Section.

1.06 MOCK-UPS

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
C. Locate where directed.
D. Mock-up may remain as part of the completed work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.
B. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.
C. Deliver materials in factory-provided protective coverings and packaging.
D. Protect materials against damage during transit, delivery, storage, and installation at site.
E. Inspect materials upon delivery for damage. Replace damaged items.
F. Prior to installation, store materials and components under cover in dry location.

1.08 FIELD CONDITIONS

A. Ambient Conditions:
   1. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F and maximum 95 degrees F.

2. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after railing installation.

B. Field Measurements: Verify actual dimensions by field measurement before fabrication. Show recorded measurements on shop drawings.

1.09 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard 1-year warranty against defects in materials, fabrication, finishes, and installation commencing on mm-dd-yyyy; complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 DELEGATED DESIGN

A. Delegated Design: See Section 01 3000 - Administrative Requirements.

B. Engage a qualified professional engineer, as defined in Section 01 4000 - Quality Requirements, to design decorative metal railings.

2.02 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

D. Life Cycle: Products in this section to have LCA as specified in Section 016000.

E. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
         1) Concentrated load of 200 lbf applied in any direction.
         2) Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
         1) Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Comply with ASTM E985.

2.04 REGULATORY REQUIREMENTS

A. California:
   1. Railings and handrails to comply with CBC Section 11B-505:

a. Top of gripping surfaces of handrails shall be 34 inches minimum and 38 inches maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above such surfaces.
b. Clearance between handrail griping surfaces and adjacent surfaces shall be 1-1/2 inches minimum. Handrail may be located in a recess if the recess is 3 inches maximum deep and 18 inches minmum 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 griping surfaces shall not be obstructed for more than 20 percent of their length. Where provided, horizontal projections shall occur 1-1/2 inches 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 inches minimum and 2 inches maximum.
e. Handrail gripping surfaces with a non-circular cross section shall have an outside dimension of 4 inches minimum and 6-1/4 inches maximum, and a cross-sectional dimension of 2-1/4 inches 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 continouous handrails at the inside turn of switchback or dogleg stairs and ramps.
i. 2 inches minimum high curb or a barrier shall be provided to prevent the passage of a 4 inches diameter sphere rolling off the sides of a ramp surface. Such a curb or a barrier shall be continuous and uninterrupted along the length of a ramp. CBC Section 11B-405.9.2.

B. Texas:
1. Railings and handrails to comply with ICC (IBC) Sections 1011.11 Handrails, 1014 Handrails, and 1015 Guards.

2.05 MANUFACTURERS

A. Decorative Metal Railings:
1. Aluminum Tube Railings (ATR).
2. C.R. Laurence.
3. Framelss HardwareCompany.
4. HDI Railing Systems.
5. Julius Blum & Co.
6. Livers Bronze.
7. Viva Railings.
8. Wagner.
9. Substitutions: See Section 01 2500 - Substitution Procedures.

2.06 DECORATIVE METAL RAILING SYSTEMS, GENERAL

A. Configurations: Refer to Architectural drawings.

B. General: Factory- or shop-fabricated to suit project conditions, for proper connection to building structure, and in largest sizes practical for delivery to site.

2.07 DECORATIVE METAL RAILING SYSTEMS WITH METAL INFILL

A. Metal Railing: Engineered, post-supported railing system with metal infill.

1. Products:
    a. Viva Railings; Blade.
    b. Substitutions: See Section 01 2500 - Substitution Procedures.
2. Decorative Flanges for Embedded Posts: Circular, collared cover plate without screw holes.
3. Fasteners: Concealed.
4. Picket Infill: Vertical pickets.
    a. Horizontal Spacing: Maximum 4 inches on center.
    b. Material: Aluminum tube.
    c. Shape: Round.
5. Pipe Infill: Pipe or tube rails sloped parallel to stair.
    a. Outside Diameter: 1-1/4 inches.
    b. Material: Aluminum pipe or tube, round.
    c. Vertical Spacing: Maximum 4 inches on center.
6. Metal Mesh Infill: Metal mesh panels.
    a. Metal Infill Panels: Welded wire mesh; 1/8-inch diameter steel wire, 2- by 2-inches pattern and 1/8-inch thick steel sheet hem with manufacturer's standard factory-applied coating.

2.08 DECORATIVE STRUCTURAL GLASS RAILING SYSTEMS

A. Structural Glass Railing System, Base-Mounted: Engineered, base-shoe supported railing system with structural glass.
    1. Products:
        a. Viva Railings; Shoe.
        b. Substitutions: See Section 01 2500 - Substitution Procedures.
    2. Glazing: Type GL-
        a. See Section 088000 - Glazing for additional information.

B. Structural Glass Railing System, Clamp-Mounted: Engineered, point-supported railing system with structural glass.
    1. Products:
        a. Viva Railings; Visio.
        b. Substitutions: See Section 01 2500 - Substitution Procedures.
    2. Clamps: Stainless steel pressure clamps; no holes drilled in glass.
    3. Glazing: Type GL-
        a. See Section 088000 - Glazing for additional information.

C. Glazed Post Railing System: Engineered, post-supported railing system with glass infill panels.
    1. Products:
        a. Viva Railings; Blade.
        b. Substitutions: See Section 01 2500 - Substitution Procedures.
    2. Glazing: Type GL-
        a. See Section 088000 - Glazing for additional information.
    3. Glass Mounts: Pressure clamps infill mounts, same metal as railing; no holes drilled in glass.

D. Glazed Button Railing System: Engineered base and point-supported railing system with glass infill.
    1. Products:
        a. C.R. Laurence; SRS Standoff Glass Railing System.
        b. Viva Railings; View.
        c. Substitutions: See Section 01 2500 - Substitution Procedures.
    2. Concealed Fasteners: 2-inch diameter, 3/4-inch thick stainless steel buttons.

3. Spacer Grommets: Washers.
4. Glazing: Type GL-
    a. See Section 088000 - Glazing for additional information.

2.09 DECORATIVE POST AND CABLE RAILING SYSTEMS

A. Post and Cable Railing System:
    1. Products:
        a. .
        b. Substitutions: See Section 01 2500 - Substitution Procedures.
    2. Cable: ASTM A555/A555M.
        a. Fabricate from ASTM A666/A666M stainless steel, Type 304 or Type 316.
        b. Size: 3/16-inch diameter.
    3. Fittings: Type 304 or Type 316 stainless steel, nonswage.
    4. Fasteners: Stainless steel.
    5. Finishes:
        a. Exposed Stainless Steel Pipe and Tubing: No.4 satin finish.
        b. Exposed, Machined Stainless Steel Fittings: No.4 satin finish.

2.10 DECORATIVE METAL PANEL RAILING SYSTEMS

A. Metal Panel Railing System: Engineered railing system of metal panels with integral vertical and horizontal supports; panels mechanically fastened to each other and to mounting stanchions.
    1. Products:
        a. Viva Railings; Metal Panel Railing System.
        b. Substitutions: See Section 01 2500 - Substitution Procedures.
    2. Mounting Stanchions: Stainless steel.

2.11 DECORATIVE METAL RAILING SYSTEMS WITH INTEGRAL LIGHTING

A. Railing System with Integral Lighting: Engineered, post-supported railing system.
    1. Products:
        a. Viva Railings; iRail.
        b. Substitutions: See Section 01 2500 - Substitution Procedures.
    2. Lighting: Manufacturer's standard, factory-installed LED system.

2.12 WINDSCREEN SYSTEM

A. Windscreen System:
    1. Products:
        a. C.R. Laurence; Frameless Glass Windscreen.
        b. Substitutions: See Section 01 2500 - Substitution Procedures.
    2. Configuration: Segmented glass panels.
    3. Anchors: Stainless steel bolts with plastic isolator sleeves.
    4. Glazing: Type GL-
        a. See Section 088000 - Glazing for additional information.

2.13 MATERIALS

A. Aluminum Components: ASTM B221 or ASTM B221M.
    1. Tubes: Schedule 40 pipe.
    2. Extruded Aluminum: ASTM B221 or ASTM B221M, 6063 alloy, T6 temper.

3. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.
4. Bolts, Nuts, and Washers: Stainless steel.
5. Welding Materials: AWS D1.2/D1.2M.

B. Stainless Steel Components: ASTM A666/A666M, Type 304.
1. Stainless Steel Tubing: ASTM A554, Type 304, 16-gauge, 0.0625-inch minimum metal thickness, 1-1/2-inch diameter.
2. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

C. Steel Components:
1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
2. Tubing: ASTM A501/A501M structural tubing, round and shapes as indicated.
3. Pipe: ASTM A53/A53M Grade B, Schedule 40, black finish.
4. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230) with G40 (Z120) coating.
5. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, galvanized in accordance with ASTM A153/A153M.
6. Welding Materials: AWS D1.1/D1.1M.

D. Glass and Glazing: See Section 088000 - Glazing.

2.14 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.
1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water.
1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
1. Ease exposed edges to small uniform radius.
2. Welded Joints:
a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.

G. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

2.15 FINISHES

A. General: Comply with NAAMM AMP 500-06.
1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions, and surface blemishes to match sheet.
2. Protect mechanical finishes on exposed surfaces from damage.

3. Apply organic and anodic finishes to formed metal after fabrication.
4. Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

B. Aluminum Finishes:
1. Anodized Finish: See Section 050511 - Surface Preparation and Finishing of Metals, for additional information.
a. AAMA 611-compliant Class I clear anodized coating.
2. Shop-Applied Coating Finish: See Section 050513 - Shop-Applied Coatings for Metal, for additional information.
a. AAMA 2605-compliant superior coating.
1) Color: As selected by Architect from manufacturer's standard range.
3. High-Performance Coating: See 099600 - High-Performance Coatings.
4. Touch-Up Materials: As recommended by coating manufacturer for field application.

C. Steel Finishes:
1. Galvanized Finish: See Section 050511 - Surface Preparation and Finishing of Metals, for additional information.
2. Shop-Applied Coating Finish: See Section 050513 - Shop-Applied Coatings for Metal, for additional information.
a. AAMA 2605-compliant superior coating.
1) Color: As selected by Architect from manufacturer's standard range.
3. High-Performance Coating: See 099600 - High-Performance Coatings.

D. Stainless Steel Finishes:
1. Stainless Steel Finish: See 050511 - Surface Preparation and Finishing of Metals.
2. Directional Satin: No.4.

2.16 ACCESSORIES

A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

B. Anchors and Fasteners: Provide anchors, fasteners, and other attachment devices required to attach to structure.
1. Stainless Steel Fasteners: Type 304.
2. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing; provide only where exposed fasteners are unavoidable.

C. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 0.015-inch dry film thickness per coat.

D. Finish Touch-Up Materials: As recommended by manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions are corrected.

3.02 PREPARATION

A. Protection of In-Place Conditions: Protect existing work before proceeding with installation.

B. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.

C. Clean surfaces to receive railings. Remove materials and substances detrimental to installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.
   5. Repair galvanizing with galvanizing repair paint in accordance with ASTM A780/A780M.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Owner to engage a qualified testing agency to perform tests and inspections.
   1. Decorative metal railings will be considered defective if they do not pass tests and inspections.
   2. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   3. Testing and inspecting agency to prepare reports and deliver to Owner or Contractor.
   4. Submit field quality control reports to Architect.

C. Tests:
   1. Test railings for structural performance in accordance with ASTM E935.

D. Manufacturer Services: Provide services of manufacturer's field representative to observe railing installation.
   1. Manufacturer's representative to prepare site review and inspection reports and deliver to Contractor.
   2. Submit field quality control reports to Architect.

3.05 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove protective film from exposed metal surfaces.

C. Metal: Clean exposed metal finishes with potable water and mild detergent in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage material or finish.

D. Glass and Glazing: Clean glazing surfaces; remove excess glazing sealant compounds, dirt, and other substances.

3.06 PROTECTION

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements.
B. Protect installed components and finishes from damage after installation.
C. Repair damage to exposed, making finishes indistinguishable from undamaged areas.
D. Replace finishes and components that have irreparable damage. Ensure damaged areas are indistinguishable from undamaged finishes and surfaces.

END OF SECTION

SECTION 057500
DECORATIVE FORMED METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative fabrications made of formed metal sheet, including:
   1. Closures, trim, and filler panels.
   2. Lighting coves.
   3. Metal base.
   4. Pockets for window treatment.
   5. Factory-fabricated column covers.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Non-decorative metal fabrications.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use; 2014 (Reapproved 2020).

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

G. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

H. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

I. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data - Sheet Metal Material: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Specimen warranty.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. CAL (CDPH SM) compliance data.

3. Recycled content data.

D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Show actual field measurements on shop drawings.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the fabrications must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.

E. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product in color and texture.

G. Fabricator's Qualification Statement.

H. Installer’s Qualification Statement.

I. Maintenance Data: Care of finishes and warranty requirements.

J. Warranty.

1.05 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.

B. Fabricator Qualifications: Company specializing in fabricating products specified in this section.
   1. With not less than 5 years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section.
   1. With minimum 3 years of documented experience.
   2. Approved by fabricator.

D. Mock-Ups: See Section 01 4000 - Quality Requirements.
   1. Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   2. Locate where directed.
   3. Provide products finished as specified.
   4. Mock-up may remain as part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

C. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well-ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.

3. Store at a slope to ensure positive drainage of accumulated water.
4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.
5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

D. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.07 WARRANTY

A. See Section 01 6000 - Product Requirements and Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's standard warranty for each product.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

D. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.02 PERFORMANCE REQUIREMENTS

A. Thermal Movements:
1. Allow for thermal movements in exterior metal fabrications due to temperature changes. Prevent buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
2. Temperature Change Range: 120 degrees F, ambient; 180 degrees F, on material surfaces.

B. Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

2.03 FORMED METAL FABRICATIONS - GENERAL

A. Shop Assembly: Preassemble items to greatest extent possible. Minimize field splices and field assembly. Disassemble only as necessary for transportation and handling. Mark items clearly for assembly and installation.

B. Coordination: Match dimensions and attachment of formed metal items to adjacent construction. Produce integrated assemblies. Closely fit joints; align edges and flat surfaces unless indicated otherwise.

C. Forming: Profiles indicated. Maximize lengths. Fold exposed edges to form hem indicated or ease edges to radius indicated with concealed stiffener. Provide flat, flush surfaces without cracking or grain separation at bends.

D. Reinforcement: Increase metal thickness; use concealed stiffeners, backing materials or both. Provide stretcher leveled standard of flatness and stiffness required to maintain flatness and hold adjacent items in flush alignment.

E. Anchors: Straps, plates and anchors as required to support and anchor items to adjacent construction.

F. Supports: Miscellaneous framing, mounting, clips, sleeves, fasteners and accessories required for installation.

G. Welding and Brazing: Weld or braze joints continuously. Grind, fill or dress to produce smooth, flush, exposed surfaces. Do not discolor metal. Grind smooth, polish, and restore damaged finishes to required condition.

2.04 FORMED METAL FABRICATIONS - SHEET METAL

A. Closures, Trim and Fill Panels:
   1. Form closures from type and thickness of metal indicated.
   2. Conceal fasteners when possible.
   3. Drill and tap holes for securing to other surfaces.
   4. Provide gaskets where indicated or needed for continuous seal at adjacent surfaces.
   5. Miter or cope at corners and reinforce with bent metal plate. Form tight joints.

B. Lighting Coves: Form lighting coves from type and thickness of metal indicated. Provide cutouts for electrical wiring and fasteners. Coordinate size of coves, cutouts and anchoring system with lighting system shown on drawings.

C. Metal Base: Form metal base from type and thickness of metal indicated. Provide integral cove, reveals and other features shown on drawings.
   1. Material: Aluminum.
      a. Thickness: 16 gauge (0.050 inches).
      b. Finish:
         1) AAMA 611-compliant Class II clear anodized coating.
   2. Material: Stainless steel, Type 304.
      a. Thickness: 18 gauge (0.048 inches).
      b. Finish:
         1) No. 1: Hot-rolled, annealed, and descaled.
         2) No. 2B: Cold-rolled, bright finish.
         3) No. 2D: Cold-rolled, dull finish.
         4) Bright annealed.
         5) No. 3: Intermediate polished finish.
         6) No. 4: General purpose polished finish.
         7) No. 6: Dull, satin finish, Tampico brushed.
         8) No. 7: High luster finish.
         9) No. 8: Mirror finish.
         10) See 050511 - Surface Preparation and Finishing of Metals, for additional information.

D. Pockets for Window Treatment:
   1. Form pockets from metal of type and thickness indicated. Coordinate dimensions and attachment method with window treatment, window frames, ceiling system and other adjacent construction.
   2. Reinforce for attaching window treatment and hardware.
   3. Divide continuous pockets with built in partitions. Separate adjoining drapery and blind units, align with window mullions and accommodate filler panel at ends of pocket.

2.05 FACTORY FABRICATED COLUMN COVERS

A. Factory Fabricated Column Covers: Factory fabricated and factory finished, sheet metal column covers, mechanically fastened to structural support.

1. Material: Aluminum sheet, ASTM B209/B209M alloy 3003 or 5005.
2. Sheet Thickness: 0.125 inch, minimum.
3. Column Section Length: 12 feet, maximum, between horizontal joints.
4. Joint Type: Butt.
5. Horizontal Reveals: Manufacturer's standard; at top, bottom, and center.
6. Fasteners: Self-drilling; ASTM A449 heat treated steel, with manufacturer's standard corrosion resistant coating.
7. Aluminum Finish: Manufacturer's standard factory applied PVDF coating.
8. Color: To be selected by Architect from manufacturer's standard range.
9. Manufacturers:
   a. ATAS International.
   b. Fry Reglet.
   c. Metal Sales.
   d. MM Systems.
   e. NorthClad.
   f. SAF Metal Fabrication, a division of Southern Aluminum Finishing Company, Inc.
   g. Substitutions: See Section 01 2500 - Substitution Procedures.

2.06 MATERIALS

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections exposed to view on finished units.

B. Aluminum Sheet: ASTM B209/B209M, 5005-H32 minimum; alloy and temper recommended by aluminum producer and finisher for use and finish indicated.

C. Stainless Steel Sheet: ASTM A666/A666M, Type 304; stretcher-leveled.

D. Fasteners, General: Same basic metal and alloy as formed metal sheet unless indicated otherwise. Do not use metals incompatible with the materials joined.

E. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 15 mil dry film thickness per coat.

2.07 FINISHES

A. Anodized, Galvanized, and Stainless-Steel Finish: See 050511 - Surface Preparation and Finishing of Metals, for additional information.

B. Shop-Applied Coating Finish: See Section 050513 - Shop-Applied Coatings for Metal, for additional information.

C. Interior Paint Finish: See 099123 - Interior Painting.

D. High-Performance Coating: See 099600 - High-Performance Coatings.

E. Finishes, General: Comply with NAAMM AMP 500-06.
   1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions and surface blemishes to match sheet.
   2. Protect mechanical finishes on exposed surfaces from damage.
   3. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
   4. Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

B. Coat concrete and masonry surfaces that will be in contact with metal surfaces with bituminous coating.

3.03 INSTALLATION - SHEET METAL AND PLATE FABRICATIONS

A. Locate and place decorative formed sheet metal items level and plumb; align with adjacent construction. Cut, drill and fit as required to install.

B. Do not cut or abrade sheet metal finishes that cannot be completely restored in the field. Return such items to manufacturer or fabricator for required alterations and refinishing or provide new items.

C. Use concealed anchorages where possible. Provide washers where needed on bolts or screws to protect metal surfaces and make weathertight connection.

D. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers indicated.

E. Install gaskets, joint fillers, insulation, sealants, and flashings as work progresses.
   1. Make exterior decorative formed sheet metal items weatherproof.
   2. Make interior decorative formed metal items soundproof or lightproof as required.

F. Corrosion Protection: Apply permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with incompatible substrate materials. Prevent corrosion damage to material and finish.

3.04 CLEANING

A. Restore finishes damaged during installation and construction period. Return items that cannot be refinished in the field to manufacturer or fabricator. Refinish entire unit or provide new units.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.05 PROTECTION

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements.

B. Protect installed products from damage from subsequent construction activities.

END OF SECTION

SECTION 057700
DECORATIVE EXTRUDED METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative extruded metal components.

1.02 REFERENCE STANDARDS

A. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings; 2020.

E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers; 2017.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal requirements.

B. Delegated Design Documents: See Section 01 3000 - Administrative Requirements.
   1. Provide design documentation prepared by Contractor's Licensed Professionals.

C. Product Data: For each item to be installed.

D. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. CAL (CDPH SM) compliance data.
   3. Life cycle data.
   4. Recycled content data.

E. Shop Drawings: Include plans, elevations, sections, and attachment details.

F. Samples: Of typical component, for each type and color of exposed finish specified.

G. Certificates: Products to meet or exceed specified requirements.

H. Structural calculations.

I. Test reports.

J. Evaluation Service Reports: From ICC or similar. Show compliance with specified requirements.

K. Manufacturer's installation instructions.

L. Contractor's Professional Engineer's qualification statement.

M. Qualification Statements: For manufacturer and installer.

N. Maintenance data.

O. Warranty.

P. Project Record Documents: See Section 01 7800 - Closeout Submittals.

1.04 COORDINATION

A. Coordinate installation of decorative extruded metal components that are anchored to other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.05 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.
   1. Contractor's Professional Engineer: Experienced in providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which the project is located.
   2. Manufacturer: Minimum five years manufacturing components specified in this Section.
   3. Installer: Approved by manufacturer to install components specified in this Section.

B. Preinstallation Meetings: See Section 01 3000 - Administrative Requirements.
   1. Convene minimum 2 weeks before starting work of this Section.

C. Mock-ups: See Section 01 4000 - Quality Requirements.
   1. Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   2. Approved mock-ups may remain as part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing.

C. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location.

D. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions by field measurement before fabrication. Show recorded measurements on shop drawings.

1.08 WARRANTY

A. See Section 01 6000 - Product Requirements and Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Warranty: Manufacturer agrees to repair or replace components that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 DELEGATED DESIGN

A. Delegated Design: See Section 01 3000 - Administrative Requirements.

B. Engage a qualified professional engineer, as defined in Section 01 4000 - Quality Requirements, to design decorative extruded metal system, including attachment to building construction.

2.02 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

D. Life Cycle: Products in this section to have LCA as specified in Section 016000.

E. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.03 PERFORMANCE REQUIREMENTS

A. General: Installed decorative metal systems to withstand wind and other structural loads imposed on them. Refer to structural drawings for additional information.

B. Movement: Accommodate movement within system without damage to components or movement within system: movement between system and perimeter components when subject to seasonal temperature cycling: dynamic loading and release of loads: deflection of structural support framing.

2.04 MANUFACTURERS

A. Manufacturers:
   1. B+N Industries.
   2. Knotwood.
   3. Longboard.
   4. Lumabuilt.
   5. Substitutions: Section 01 2500 - Substitution Procedures.

B. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

2.05 DECORATIVE EXTRUDED METAL

A. System Description: Extruded aluminum profiles, with manufacturer-applied proprietary finish resembling wood. Stock material is cut and assembled on site.
   1. Furnish all components necessary for a complete system installation.

B. Planks: Tongue and groove aluminum panel extrusions.
   1. Products:
      a. B+N Industries; Fortina Slats.
      b. Knotwood; Cladding.
      c. Longboard; Cladding.
      d. Lumabuilt; Mosaic Plank.
      e. Substitutions: See Section 01 2500 - Substitution Procedures.
   2. Finish: As selected by Architect from manufacturer's full range.

C. Battens: Tubular aluminum extrusions.
   1. Products:
      a. B+N Industries; Fortina Battens.
      b. Knotwood; Battens.
      c. Longboard; Privacy Screen.
      d. Lumabuilt; Mosaic Batten.
      e. Substitutions: See Section 01 2500 - Substitution Procedures.
   2. Finish: As selected by Architect from manufacturer's full range.

2.06 ACCESSORIES

A. Fasteners:
   1. Aluminum Components:
      a. Aluminum.
      b. Type 304 stainless-steel with washer to prevent galvanic corrosion, if approved by manufacturer.
   2. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

2.07 MATERIALS

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
   1. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B221, Alloy 6063-T5/T52.
   2. Plate and Sheet: ASTM B209/B209M, Alloy 5005-H32 or Alloy 6061-T6.
   3. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.
   4. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.08 FABRICATION

A. General: Fabricate decorative extruded metal components to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form work true to line and level with accurate angles and surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. See Section 01 7000 - Execution and Closeout Requirements.

B. Verification of Conditions: Confirm that supporting structure is ready to receive work of this Section.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions and approved shop drawings.

B. Perform cutting, drilling, and fitting required for installing components. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
   1. Set components plumb within a tolerance of 1/16 inch in 3 feet.
C. Fit exposed connections together to form tight, hairline joints.
D. Do not install over cementitious materials, dissimilar metals, or pressure treated material without adequate barrier protection.
E. Install components to accommodate expansion control.
F. Install connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
G. Modify and install components in a manner to prevent damage to factory-applied finish. Replace damaged components.

3.03 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements.
B. Clean components by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.04 PROTECTION

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements.
B. Provide barrier or other delineation to prevent damage to installed Work from subsequent construction activities.

END OF SECTION

SECTION 062000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

1.02 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
B. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
F. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.
G. PS 1 - Structural Plywood; 2023.
H. PS 20 - American Softwood Lumber Standard; 2021.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data:
    1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
    2. Provide data on fire retardant treatment materials and application instructions.
    3. Provide instructions for attachment hardware and finish hardware.
C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
    1. VOC content restrictions data.
    2. CAL (CDPH SM) compliance data.
    3. Sustainable wood data.
    4. Regional product data.
    5. Recycled content data.

D. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   2. Include certification program label.

E. Samples: Submit two samples of finish plywood, 6 x 6 inches in size illustrating wood grain and specified finish.

F. Samples: Submit two samples of wood trim 6 inches long.

G. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

H. Manufacturer's Instructions: Provide manufacturer's installation instructions for factory-fabricated units.

1.05 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

C. Quality Certification:
   1. Provide labels or certificates indicating that work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   2. Provide designated labels on shop drawings as required by certification program.
   3. Provide designated labels on installed products as required by certification program.
   4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.
   1. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

C. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

D. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location.

E. Handle materials and products to prevent damage to edges, ends, or surfaces.

F. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

D. Sustainable Wood: Products in this Section to meet sustainable wood requirements specified in Section 016000.

E. Regional Content: Products in this Section to meet regional requirements specified in Section 016000.

F. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.02 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.

2.03 LUMBER MATERIALS

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
   2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

2.04 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
   1. Grading: Certified by the American Plywood Association.

C. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

2.05 FASTENINGS

A. Exterior Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

B. Interior Wood Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
   1. Paneling Adhesive: Comply with paneling manufacturer's written instructions for adhesives.
   2. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

C. Fasteners for Exterior Applications: Stainless steel; length required to penetrate wood substrate 1-1/2 inch minimum.

D. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

2.06 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

C. Wood Preservative (Surface Application): Colored, _____ type, _____.

D. Shop pressure treat wood materials requiring fire rating to concealed wood blocking.

E. Provide identification on fire retardant treated material.

F. Redry wood after pressure treatment to maximum ____ percent moisture content.

2.07 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: Comply with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.08 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Back out or kerf backs of the following members, except those with ends exposed in finished work:
   1. Interior standing and running trim, except shoe and crown molds.
   2. Wood-board paneling.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.09 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 11, Polyurethane, Catalyzed.
      b. Sheen: Flat.
   2. Opaque:
      a. Exterior Paint Finish: See 099113 - Exterior Painting.
      b. Interior Paint Finish: See 099123 - Interior Painting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Verify adequacy of backing and support framing.

D. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Install factory-fabricated units in accordance with manufacturer's printed installation instructions.

C. Set and secure materials and components in place, plumb and level.

D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

END OF SECTION

SECTION 071400
FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hot-applied rubberized asphalt waterproofing system.
B. Cold-applied rubberized asphalt waterproofing system.
C. Polyurethane waterproofing system.
D. Polyurea waterproofing system.
E. Cold-applied elastomeric polymer dispersion waterproofing system.
F. Cold-applied polyurethane-methacrylate (PUMA) waterproofing system.

1.02 REFERENCE STANDARDS

A. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2018 (Reapproved 2022).
B. ASTM C957/C957M - Standard Specification for High-Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane With Integral Wearing Surface; 2017.
C. ASTM C1305 - Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane; 2016.
D. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
E. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.
F. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).
G. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
H. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2022.
I. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 2025.
J. ASTM D7877 - Standard Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes; 2024.
K. ASTM D8231 - Standard Practice for the Use of a Low Voltage Electronic Scanning System for Detecting and Locating Breaches in Roofing and Waterproofing Membranes; 2019.
L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
M. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: For each item to be installed.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. Life cycle data.
   3. Recycled content data.

D. Certificates: Products to meet or exceed specified requirements.

E. Shop Drawings: Show details for substrate joint and crack treatment, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.

F. Test reports.

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

H. Manufacturer's Installation Instructions: Indicate special procedures.

I. Manufacturer's qualification statement.

J. Installer's qualification statement.

K. Field Quality Control Reports: As specified in Part 3 of this Section.

L. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's documentation that installation complies with warranty conditions for the field-applied waterproofing.

1.04 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.
   1. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years documented experience.
   2. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

B. Preinstallation Meetings: See Section 01 3000 - Administrative Requirements.
   1. Convene minimum 2 weeks before starting work of this Section.
   2. Conduct conference at Project site.
   3. Review waterproofing requirements, including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.05 MOCK-UPS

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Construct mock-up consisting of 100 sq ft of horizontal and vertical fluid-applied waterproofing; to represent finished work including internal and external corners, drainage panel, base flashings, control joints, expansion joints, counterflashings, and protective cover.

C. Locate where directed.

D. Mock-up may remain as part of Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing.

C. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location.

D. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.07 FIELD CONDITIONS

A. Ambient Conditions: Maintain ambient temperature and humidity as required by manufacturer for each product to be installed, before and after installation.

1.08 WARRANTY

A. See Section 01 6000 - Product Requirements and Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Special Warranty: Manufacturer agrees to repair or replace waterproofing systems that do not comply with requirements or that fail to remain watertight within specified warranty period.
   1. Warranty includes removing and reinstalling protection board, drainage panels, and overburden.
   2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Installer's Warranty: Specified form signed by Installer, covering Work of this Section, for warranty period of two years from date of Substantial Completion.
   1. Warranty includes removing and reinstalling protection board, drainage panels, and overburden.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. Life Cycle: Products in this section to have LCA as specified in Section 016000.

D. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.02 MANUFACTURERS

A. Hot-Applied Rubberized Asphalt Waterproofing:
   1. Barrett Company.
   2. Carlisle.
   3. Cetco.
   4. Cetco.
   5. Henry.
   6. Hydro-Gard.
   7. Sika Roofing & Waterproofing (formerly American Hydrotech).

8. Soprema.
9. Tremco.
10. W.R. Meadows.
11. Substitutions: See Section 01 2500 - Substitution Procedures.

B. Polyurethane Waterproofing:
1. Cetco.
2. C.I.M. Industries.
3. Gaco Western (Firestone Building Products).
4. Tnemec.
5. Tremco.
6. Substitutions: See Section 01 2500 - Substitution Procedures.

C. Polyurea Waterproofing:
1. GCP Applied Technologies.
2. Henry (Carlisle).
3. Substitutions: See Section 01 2500 - Substitution Procedures.

D. Cold-Applied Polyurethane-Methacrylate (PUMA) Waterproofing System:
1. Cetco.
2. Henry (Carlisle).
3. Tremco.
4. Substitutions: See Section 01 2500 - Substitution Procedures.

2.03 FLUID-APPLIED WATERPROOFING, GENERAL

A. Refer to Architectural drawings for locations and extents of assembly types.

B. Provide all components necessary for a complete system.

2.04 HOT-APPLIED RUBBERIZED ASPHALT WATERPROOFING SYSTEM

A. Hot-Applied Rubberized Asphalt Waterproofing: Elasticized rubberized asphaltic compound, hot-applied and quick setting.
1. Assembly:
a. Primer.
b. Membrane, 90 mils minimum first pass.
c. Reinforcement:
1) Fabric Reinforcement: 1.3 oz/sq. yd. spunbonded polyester.
(a) Locations: Typical unless noted otherwise.
2) Rubber Reinforcement: 60 mil uncured neoprene.
(a) Locations: Cracks, joints, terminations, and as otherwise recommended by manufacturer.
d. Membrane, 125 mils minimum second pass.
2. Physical Properties:
a. Capable of resisting 100 maximum water head of 231 feet and preventing moisture migration to interior, tested in accordance with ASTM D5385/D5385M.
b. Ultimate Elongation: 1000 percent, minimum, measured in accordance with ASTM D412.
c. Water Vapor Permeance: 0.27 perms, maximum, measured in accordance with ASTM E96/E96M.
d. Finished Coating Thickness: 215 mil, 0.215 inch, minimum.
e. Liquid-Applied Flashing: Manufacturer's recommended multicomponent, reinforced, UV stabilized poly methyl-methacrylate (PMMA) resin flashing compatible with waterproofing membrane and suitable for exposed conditions.

3. Products:
    a. Barrett Company, LLC, member of Keene Family of Companies; RamTough 250 - Hot Rubberized Asphalt Waterproof Membrane: www.barrettroofs.com/#sle.
    b. CETCO, a division of Minerals Technologies Inc; STRATASEAL HR: www.mineralstech.com/#sle.
    c. Henry, a Carlisle Company; 790-11: www.henry.com/#sle.
    d. Hydro-Gard; Hydro-Tuff: www.hydro-gard.com/#sle.
    e. Sika Roofing & Waterproofing (formerly American Hydrotech); Hydrotech Monolithic Membrane 6125: www.hydrotechusa.com/#sle.
    f. Soprema, Inc; COLPHENE H: www.soprema.us/#sle.
    g. Tremco Commercial Sealants & Waterproofing; TREMproof 6100: www.tremcosealants.com/#sle.
    h. W. R. Meadows, Inc; HRM 714: www.wrmeadows.com/#sle.
    i. Substitutions: See Section 01 2500 - Substitution Procedures.
4. Locations:

2.05 POLYURETHANE WATERPROOFING SYSTEM

A. Polyurethane Waterproofing: Cold-applied, high solids content polyurethane waterproofing complying with ASTM C836/C836M.
    1. Physical Properties:
        a. Cured Thickness: 60 mil, 0.060 inch, minimum.
        b. Tensile Strength: 400 psi, minimum, measured in accordance with ASTM D412.
        c. Ultimate Elongation: 400 percent, minimum, measured in accordance with ASTM D412.
        d. Durometer Hardness, Type A: 30, minimum, in accordance with ASTM D2240.
        e. Permeance: 0.03 perm, maximum, measured in accordance with ASTM E96/E96M.
        f. Adhesion: 350 psi, minimum, measured in accordance with ASTM D4541.
    2. Products:
        a. CETCO, a division of Minerals Technologies Inc; LDC 60: www.mineralstech.com/#sle.
        b. C.I.M. Industries; CIM 1000.
        c. Gaco Western; GacoFlex LM-60: www.gaco.com/#sle.
        d. Tnemec; Series 262 Elasto-Shield.
        e. Tremco Commercial Sealants & Waterproofing; TREMproof 250GC: www.tremcosealants.com/#sle.
        f. Substitutions: See Section 01 2500 - Substitution Procedures.
    3. Locations:

2.06 POLYUREA WATERPROOFING SYSTEM

A. Two-Component Polyurea Waterproofing: 100 percent solids elastomeric polyurea membrane.
    1. Physical Properties:
        a. Limitations:
            1) Use only for above-grade applications, including split slabs, water tanks, planters, and terraces.
            2) Cannot be applied over lightweight insulating concrete.
        b. Thickness: 100 mils field, 140 mils details and transitions, minimum.
        c. Tensile Strength (ASTM C957/C957M): 1,600 psi.
        d. Elongation (ASTM C957/C957M): 300 percent.
        e. Crack Bridging (ASTM C1305): Pass.
        f. Root Resistance: Pass.

g. Hydrostatic Pressure (ASTM D5385/D5385M): 130 psi.

2. GProducts:
   a. GCP Applied Technologies; Silcor 900MP (spray-applied) and 900HA (hand-applied).
   b. Henry (Carlisle); Prodeq FX 400.
   c. Substitutions: See Section 01 2500 - Substitution Procedures.
3. Water Containment Products:
   a. Henry (Carlisle); Qontain.
   b. Substitutions: See Section 01 2500 - Substitution Procedures.

2.07 COLD-APPLIED POLYURETHANE-METHACRYLATE (PUMA) WATERPROOFING SYSTEM

A. Cold-Applied Polyurethane-Methacrylate (PUMA) Waterproofing System: High-percent solids polyurethane-methacrylate, or composite PMMA (polymethyl methacrylate) / PUMA system, with reinforcement.
   1. Physical Properties:
      a. Application: Waterproofing concrete slabs.
      b. Cured Thickness: 97 mil, 0.097 inch, minimum, with applied base coat and top coat.
      c. Suitable for installation over concrete substrates properly prepared in accordance with manufacturers requirements.
   2. Assembly:
      a. Primer: Two-component, methyl-methacrylate (MMA) based.
      b. Base Coat: Modified polyurethane-methacrylate (PUMA) that bonds firmly to primer.
         1) Elongation: 407 percent, minimum, measured in accordance with ASTM D638.
         2) Tensile Strength: 1,680 psi, minimum, at 75 degrees F, measured in accordance with ASTM D638.
         3) Durometer Hardness, Type D: 35, minimum, measured in accordance with ASTM D2240.
      c. Top Coat: Methyl-methacrylate (MMA) based, with excellent abrasion resistance, UV stability and chemical resistance.
         1) Elongation: 130 percent, minimum, measured in accordance with ASTM D638.
         2) Tensile Strength: 986 psi, minimum, at 75 degrees F, measured in accordance with ASTM D638.
         3) Durometer Hardness, Type D: 55, minimum, measured in accordance with ASTM D2240.
      d. Color: As selected by Architect.
   3. Products:
      a. CETCO, a division of Minerals Technologies Inc; CETGUARD SG: www.mineralstech.com/#sle.
      b. Henry (Carlisle); Pumadeq.
      c. Tremco; TremProof PUMA Below-Grade.
      d. Substitutions: See Section 01 2500 - Substitution Procedures.

2.08 ACCESSORIES

A. General: Auxiliary materials recommended by waterproofing manufacturer for intended use, compatible with waterproofing membrane, and as necessary to support specified warranty.

B. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.

C. Flexible Flashings: Type recommended by membrane manufacturer.

D. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.

1. Composition: Dimpled polyethylene, polypropylene, or polystyrene core; polypropylene or polyester filter fabric.
2. Flow Rate: 9 to 21 gpm per ft., or as otherwise recommended by manufacturer for location and conditions.
3. Core Compressive Strength: 15,000 psf, minimum, in accordance with ASTM D1621
4. Product: As recommended by membrane manufacturer.

E. Metal Termination Bars: Manufacturer's standard, pre-drilled stainless steel termination bars; approximately 1 by 1/8 inch thick, with stainless steel anchors.

PART 3 EXECUTION

3.01 EXAMINATION

A. See Section 01 7000 - Execution and Closeout Requirements.

B. Verify existing conditions before starting work.

C. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

D. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

E. Verify that items penetrating surfaces to receive waterproofing are securely installed.

F. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

G. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. See Section 01 7000 - Execution and Closeout Requirements.

B. Protect adjacent surfaces from damage not designated to receive waterproofing.

C. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

D. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.

E. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

F. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

3.03 INSTALLATION

A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions, NRCA (WM), and approved shop drawings.

B. Do not exceed pot life of material as documented in writing by manufacturer.

C. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

D. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward, and scribe and cut boards around projections, penetrations, and interruptions.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Owner to engage a qualified testing agency to perform tests and inspections.
   1. Fluid-applied waterproofing will be considered defective if it does not pass tests and inspections.
   2. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   3. Testing and inspecting agency to prepare reports and deliver to Owner or Contractor.
   4. Submit field quality control reports to Architect.

C. Tests:
   1. Electronic Leak Detection (ELD) Testing: Test waterproofed areas for leaks using ELD method that locates discontinuities in fluid-applied waterproofing in accordance with ASTM D7877 or ASTM D8231.
      a. Testing agency to create a conductive electronic field over the entire installed membrane and determine locations of discontinuities or leaks, if any. Include abutting or overlapping smaller areas as necessary to cover entire installed membrane.

D. Manufacturer's Representative to provide site monitoring and inspection services as specified in Section 01 4000.
   1. Manufacturer's representative to prepare site review and inspection reports and deliver to Contractor.
   2. Submit field quality control reports to Architect.

3.06 PROTECTION

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements.

B. Provide barrier or other delineation to prevent damage to installed Work from subsequent construction activities.

C. Do not permit traffic over unprotected or uncovered membrane.

SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Joint sealants.

B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Restrictions: Additional requirements for sealants and primers.

B. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 DEFINITIONS

A. Refer to ASTM C920 for additional information.
   1. Type S: Single-component.
   2. Type M: Multi-component.
   3. Grade P: Pourable or self-leveling, for horizontal applications.
   4. Grade NS: Non-sag or gunnable, for vertical applications.
   5. Class 100/50: Accepts at least 100 percent increase and 50 percent decrease of joint width.
   6. Class 50: Accepts at least 50 percent increase and decrease of joint width.
   7. Class 35: Accepts at least 35 percent increase and decrease of joint width.
   8. Class 25: Accepts at least 25 percent increase and decrease of joint width.
   9. Class 12-1/2: Accepts at least 12-1/2 percent increase and decrease of joint width.
   10. Use T1: Designed for pedestrian and vehicular traffic areas, with a high durometer (hardness).
   11. Use T2: Designed for pedestrian and vehicular traffic areas, with a lower durometer (hardness).
   12. Use NT: Designed for non-traffic areas.
   13. Use I: Designed to be continuously submerged in liquid (immersion service).
   14. Use M: Designed for use with mortar.
   15. Use G: Designed for use with glass. See Section 088000 - Glazing.
   16. Use A: Designed for use with aluminum.
   17. Use O: Designed for use on non-standard (other) substrates.

1.04 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

H. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

J. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

K. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

L. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
   6. Substrates for which laboratory adhesion and/or compatibility testing is required.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. CAL (CDPH SM) compliance data.
   2. VOC content restrictions data.

D. Installation instructions, including precautions, limitations, and recommended backing materials and tools.

E. Sample product warranty.

F. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

G. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

H. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

I. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

J. Installation Plan: Submit at least four weeks prior to start of installation.

K. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

L. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

M. Installation Log: Submit filled-out log for each length or instance of sealant installed.

N. Executed warranty.

1.06 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.
   1. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   2. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

B. Preinstallation Meetings: See Section 01 3000 - Administrative Requirements.
   1. Convene minimum 2 weeks before starting work of this Section.

C. Mock-ups: See Section 01 4000 - Quality Requirements.
   1. Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   2. Approved mock-ups may remain as part of the completed Work if undisturbed at time of Substantial Completion.

D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. See Section Section 01 4000 - Quality Requirements, for additional information.
   2. Adhesion Testing: In accordance with ASTM C794.
   3. Compatibility Testing: In accordance with ASTM C1087.
   4. Stain Testing: In accordance with ASTM C1248; required for stone and masonry substrates.
   5. Allow sufficient time for testing to avoid delaying the work.
   6. Deliver sufficient samples to manufacturer for testing.
   7. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
   8. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

E. Installation Plan: Include schedule of sealed joints, including the following:
   1. Joint width indicated in Contract Documents.
   2. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
   3. Approximate date of installation, for evaluation of thermal movement influence.
   4. Installation Log Form: Include the following data fields, with known information filled out.
      a. Location on project.
      b. Substrates.
      c. Sealant used.
      d. Stated movement capability of sealant.
      e. Primer to be used, or indicate no primer is used.
      f. Size and actual backing material used.
      g. Date of installation.
      h. Name of installer.
      i. Actual joint width; provide space to indicate maximum and minimum width.
      j. Actual joint depth to face of backing material at centerline of joint.
      k. Air temperature.

F. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.

1. Identification of testing agency.
2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
    a. Test date.
    b. Copy of test method documents.
    c. Age of sealant upon date of testing.
    d. Test results, modeled after the sample form in the test method document.
    e. Indicate use of photographic record of test.

G. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.
4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing.

C. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location.

D. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.08 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer, or are below 40 degrees F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

2.02 JOINT SEALANTS - GENERAL

A. Color of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

2.03 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
   2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   5. Products:
      a. Dow; DOWSIL 790 Silicone Building Sealant: www.dow.com/#sle.
      b. Dow; DOWSIL 791 Silicone Weatherproofing Sealant: www.dow.com/#sle.
      c. Dow; DOWSIL 795 Silicone Building Sealant: www.dow.com/#sle.
      d. Momentive Performance Materials, Inc/GE Silicones; SCS9000 SilPruf NB - Non-Staining Silicone Weatherproofing Sealant: www.siliconeforbuilding.com/#sle.
      e. Pecora Corporation; Pecora 890 NST (Non-Staining Technology): www.pecora.com/#sle.
      f. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
      g. Substitutions: See Section 01 2500 - Substitution Procedures.
   6. Locations:
      a. Joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints in dimension stone cladding.
      d. Joints in exterior insulation and finish systems.
      e. Joints between metal panels.
      f. Joints between different materials listed above.
      g. Permiter joints between materials listed above and frames of doors, windows, aluminum storefront and curtain wall, and louvers.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant, acid-curing; not expected to withstand continuous water immersion or traffic.
   1. Color: White.
   2. Products:

a. Dowsil; 786 Mildew Resistant.
b. GE Advanced Materials - Silicones; Sanitary SCS1700.
c. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com/#sle.
d. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.
e. Tremco; Tremsil 200 Sanitary.
f. Substitutions: See Section 01 2500 - Substitution Procedures.

3. Locations:
   a. Interior sealant joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Interior sealant joints subject to moisture.

C. Nonsag Traffic-Grade Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 20 to 30, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Products:
      a. Mapei; Mapeiflex P2 NS: www.mapei.com/#sle.

D. Tamper-Resistant Polyurethane Sealant: ASTM C920, Grade NS, Uses M, G, and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
   2. Hardness Range: 50 to 60, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Products:
      a. Pecora Corporation: www.pecora.com/#sle.

E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
   1. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
   2. Products:
      a. Bostik; Siliconized Acrylic Caulk.
      b. Pecora Corporation; AC-20 +Silicone: www.pecora.com/#sle.
      c. Sherwin-Williams Company; 850A Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
      d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
      e. Substitutions: See Section 01 2500 - Substitution Procedures.

F. Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
   1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.
   2. Service Temperature Range: Minus 13 to 180 degrees F.
   3. Products:
      a. Pecora Corporation; Pecora BC-158 Butyl Rubber Sealant: www.pecora.com/#sle.
      b. Sherwin-Williams Company; Storm Blaster All Season Sealant: www.sherwin-williams.com/#sle.
      c. Substitutions: See Section 01 2500 - Substitution Procedures.
   4. Locations:
      a. Roof panel rib sealant.
      b. Termination bars.

G. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.
   1. Products:
      a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant: www.pecora.com/#sle.
      b. Tremco Commercial Sealants & Waterproofing; Acoustical/Curtainwall Sealant: www.tremcosealants.com/#sle.
      c. Substitutions: See Section 01 2500 - Substitution Procedures.

2.04 SELF-LEVELING JOINT SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   3. Service Temperature Range: Minus 40 to 180 degrees F.
   4. Products:
      a. Master Builders Solutions; MasterSeal SL 2.
      b. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
      c. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com/#sle.
      d. Substitutions: See Section 01 2500 - Substitution Procedures.
   5. Locations:
      a. Control and expansion joints in brick pavers.
      b. Isolation and control joints in cast-in-place concrete slabs.
      c. Joints in stone paving units.
      d. Tile control and expansion joints.
      e. Joints between materials listed above.

B. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   3. Service Temperature Range: Minus 40 to 180 degrees F.
   4. Products:
      a. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com/#sle.
      b. W. R. Meadows, Inc; POURTHANE SL: www.wrmeadows.com/#sle.
      c. Substitutions: See Section 01 2500 - Substitution Procedures.

C. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids, UV-resistant; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Durometer Hardness, Type A: 85, minimum, after seven days when tested in accordance with ASTM D2240.
   2. Joint Depth: Provide product suitable for joints from 1/8 inch to 1 inch in depth excluding space for backer rod.
   3. Products:
      a. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS: www.ardexamericas.com/#sle.
      b. Euclid Chemical Company; EUCO QWIKjoint UVR: www.euclidchemical.com/#sle.
      c. Metzger McGuire; Edge-Pro.

d. SASE; FlexJoint 85.
e. VersaFlex; SL/85.
f. Substitutions: See Section 01 2500 - Substitution Procedures.

4. Locations:
   a. Exposed sawcuts and non-moving control joints in concrete slabs subject to heavy loads.

2.05 ACCESSORIES

A. Sealant Backing, General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
   1. Sealant Backing Manufacturers:
      a. Adfast.
      b. Alcot Plastics.
      c. Nomaco.
      d. W.R. Meadows.
      e. Substitutions: See Section 01 2500 - Substitution Procedures

B. Sealant Backing Rod, Closed-Cell Type:
   1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.
   2. Size: 25 to 50 percent larger in diameter than joint width.

C. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.
   1. Size: As recommended by manufacturer for Project conditions.
   2. Thickness: 0.78 inch, with ridges along outside bottom edges for bonding area.
   3. Color: As selected by Architect.
   4. Products:
      a. Tremco Commercial Sealants & Waterproofing; Spectrem Simple Seal: www.tremcosealants.com/#sle.
      b. Substitutions: See Section 01 2500 - Substitution Procedures.

D. Preformed Extruded Polyurethane Joint Seal: Medium-modulus, preformed polyurethane extrusion used to bridge joints under elastomeric wall coatings, in sizes to fit applications indicated on drawings, combined with polyurethane sealant for bonding joint seal to substrates.
   1. Size: As recommended by manufacturer for Project conditions.
   2. Thickness: 0.051 inch, with ridges along outside bottom edges for bonding area.
   3. Color: As selected by Architect.
   4. Products:
      a. Dayton Superior.
      b. Emseal (Sika).
      c. Tremco.
      d. Willseal.
      e. Substitutions: See Section 01 2500 - Substitution Procedures.

E. Backing (Bond-Breaker) Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
   1. Manufacturers:
      a. 3M.
      b. Berry Plastics Corporation.
      c. C.R. Laurence.
      d. Scapa Tapes North America.

e. Valley Industrial Products.

F. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

G. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

H. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Do not exceed pot life of material as documented in writing by manufacturer.

C. Provide joint sealant installations complying with ASTM C1193.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Owner to engage a qualified testing agency to perform tests and inspections.
   1. Joint sealants will be considered defective if they do not pass tests and inspections.
   2. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3. Testing and inspecting agency to prepare reports and deliver to Owner or Contractor.
4. Submit field quality control reports to Architect.

C. Tests:
1. Field Adhesion Testing: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
a. Perform 10 tests for the first 1,000 linear feet of joint, for each kind of sealant and joint substrate.
b. Perform 1 test for each 1,000 linear feet of joint thereafter, or one test per each floor per elevation.

D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

E. Repair destructive test location damage immediately after evaluation and recording of results.

3.05 PROTECTION

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements.

B. Protect joint sealants during and after curing period from contact with contaminating substances or damage from subsequent construction activities.

END OF SECTION

SECTION 093000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile.
B. Thresholds.
C. Ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
B. Section 092116 - Gypsum Board Assemblies: Tile backer board.

1.03 DEFINITIONS

A. General: Definitions in the ANSI A108 Series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
B. Large Format Tile: Tiles with at least one side greater than 15 inches long, per TCNA Handbook.
C. Heavy Tile: Tile that weighs over 5 pounds per square foot.
D. Module Size: Actual tile size plus joint width indicated.
E. Face Size: Actual tile size, excluding spacer lugs.
F. Dimension Stone Tile: Modular stone units less than 3/4 inch thick.
G. Gauged Porcelain: Products compliant with ANSI A137.3 produced from clay.
    1. Gauged Porcelain Tile: Gauged porcelain that is 36 inches by 36 inches and smaller.
    2. Gauged Porcelain Panel: Gauged porcelain that is larger than 36 inches by 36 inches.
H. Sintered Stone: Products formed by proprietary dry materials that are sintered: compacted under intense heat and pressure, without melting to the point of liquefaction.

1.04 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
B. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.
C. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.
D. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.
E. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation; 1999 (Reaffirmed 2021).

F. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.

G. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.

H. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2024).

I. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.

J. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

K. ANSI A138.1 - Green Squared American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials; 2011 (Reaffirmed 2021).

L. ANSI A326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials; 2021.

M. ASTM C503/C503M - Standard Specification for Marble Dimension Stone; 2023.

N. ASTM C847 - Standard Specification for Metal Lath; 2018 (Reapproved 2024).

O. ASTM C1353/C1353M - Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser; 2020, with Editorial Revision.

P. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

Q. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

R. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting minimum 2 weeks before starting work of this section; require attendance by affected installers.
   1. See Section Section 01 3000 - Administrative Requirements, for additional information.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. CAL (CDPH SM) compliance data.
   3. Life cycle data.
   4. Recycled content data.

D. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

E. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

F. Manufacturer's installation instructions.

G. Evaluation Service Reports: From ICC or similar. Show compliance with specified requirements.

H. Installer's qualification statement.

I. Field Quality Control Reports: As specified in Part 3 of this Section.

J. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Tile: 1 percent of each size, color, and surface finish combination.

1.07 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.08 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Construct tile mock-up incorporating components specified for location.
   1. Minimum size of mock-up is indicated on drawings.
   2. Mock-up may not remain as part of work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.10 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

D. Life Cycle: Products in this section to have LCA as specified in Section 016000.

E. Green Squared: When possible, provide tiles and installation materials that comply with ANSI A138.1 requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Dynamic Coefficient of Friction (DCOF): Tile floors to be minimum 0.42, in accordance with ANSI A326.3.

2.03 REGULATORY REQUIREMENTS

A. California:
   1. Ceramic tile flooring shall be stable, firm, and slip resistant. CBC Section 11B-302.1.

2.04 TILE

A. Tile Types: See Materials Plans Schedule on Landscape Drawings.
   1. Substitutions: See Section 01 2500 - Substitution Procedures.

2.05 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

B. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

C. Dimensions:
   1. Width: 2 inches wide by full width of wall or frame opening.
   2. Height: 1/2 inch, maximum .

D. Solid SurfaceThresholds: Homogeneous plastic resin complying with ISFA 2-01.
   1. Products: See Finish Schedule on the Architectural drawings.
      a. Substitutions: See Section 01 2500 - Substitution Procedures.
   2. Products:
      a. Aristech Acrylics LLC; Avonite Surfaces.
      b. Dupont; Corian and Zodiac.
      c. Formica Corporation; Solid Surfacing.
      d. Wilsonart; Gibraltar and Earthstone.
      e. Substitutions: See Section 01 2500 - Substitution Procedures.
   3. Color and Pattern: As selected by Architect.
   4. Locations:
      a. At doorways where tile terminates.
      b. At open edges of floor tile where adjacent finish is a different height.
      c. Where shown on the Architectural drawings.

E. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of 10 in accordance with ASTM C1353/C1353M.
   1. Description: Uniform, fine- to medium-grained white stone with gray veining.
   2. Finish: Honed.
   3. Locations:
      a. At doorways where tile terminates.
      b. At open edges of floor tile where adjacent finish is a different height.
      c. Where shown on the Architectural drawings.

2.06 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:

1. Ardex.
2. Bostik.
3. Custom Building Products.
4. H.B. Fuller.
5. Laticrete.
6. Mapei.
7. Parex.
8. Schluter Systems.
9. Sika.
10. Substitutions: See Section 01 2500 - Substitution Procedures.

C. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
   1. Applications: Use where large and heavy tile mortar is indicated on drawings.
   2. Products:
      a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.
      b. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
      c. TEC Specialty Products LLC; TEC TotalFlex 150 Universal Polymer-Modified Mortar: www.tecspecialty.com/#sle.
      d. LATICRETE International, Inc; MULTIMAX LITE: www.laticrete.com/#sle.
      e. Mapei Corporation; Granirapid System: www.mapei.com/#sle.
      f. Schluter-Systems; ALL-SET: www.schluter.com/#sle.
      g. Substitutions: See Section 01 2500 - Substitution Procedures.

D. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
   1. Applications: Where indicated on drawings.
   2. Products:
      a. Custom Building Products; EBM-Lite Epoxy Bonding Mortar: www.custombuildingproducts.com/#sle.
      b. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com/#sle.
      c. Mapei Corporation; Kerapoxy 410: www.mapei.com/#sle.
      d. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.
      e. Sika Corp; SikaTile 350 Flex Set: www.sika.com/#sle.
      f. Substitutions: See Section 01 2500 - Substitution Procedures.

2.07 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   2. Products:
      a. ARDEX Engineered Cements; ARDEX FL: www.ardexamericas.com/#sle.
      b. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com/#sle.
      c. TEC Specialty Products LLC; TEC Power Grout: www.tecspecialty.com/#sle.
      d. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
      e. Mapei Corporation; Ultracolor Plus FA: www.mapei.com/#sle.
      f. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/sle.
      g. Substitutions: See Section 01 2500 - Substitution Procedures.

C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Products:
      a. ARDEX Engineered Cements; ARDEX WA: www.ardexamericas.com/#sle.
      b. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.
      c. TEC Specialty Products LLC; TEC AccuColor EFX Epoxy Special Effects Grout: www.tecspecialty.com/#sle.
      d. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
      e. Mapei Corporation; Kerapoxy CQ: www.mapei.com/#sle.
      f. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.
      g. Sika Corp; SikaTile 825 Epoxy: www.sika.com/#sle.
      h. Substitutions: See Section 01 2500 - Substitution Procedures.

D. Furan Grout: ANSI A118.5 chemical resistant furan resin grout.
   1. Products:
      a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.
      b. LATICRETE International, Inc; LATICRETE SPECTRALOCK 2000 IG: www.laticrete.com/#sle.
      c. Mapei Corporation; Kerapoxy IEG CQ: www.mapei.com/#sle.
      d. Substitutions: See Section 01 2500 - Substitution Procedures.

2.08 SEALANT AND MAINTENANCE MATERIALS

A. Movement Joints: Refer to Article in Part 3 of this Section.

B. Sealant: See Section 079200 - Joint Sealants.

C. Backer Rods: Closed-cell foam polyethylene or butyl rubber, as recommended by setting material manufacturer, for use in movement joints.
   1. See Section 079200 - Joint Sealants, for products.
   2. Refer to Part 3 article "Movement Joints" for additional information.

D. Bond Breaker Tape: For use in movement joints, to prevent 3-sided adhesion.
   1. See Section 079200 - Joint Sealants, for products.
   2. Refer to Part 3 article "Movement Joints" for additional information.

E. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.
   2. Color: As selected by Architect from manufacturer's full line.
   3. Products:
      a. STONETECH, a Division of LATICRETE International, Inc; STONETECH Heavy Duty Grout Sealer: www.laticrete.com/#sle.
      b. Merkrete, by Parex USA, Inc; Merkrete Revive: www.merkrete.com/#sle.
      c. Substitutions: See Section 01 2500 - Substitution Procedures.

F. Tile Sealer: Stain protection for ceramic tile and natural stone tile. Compliant with DCOF established in Performance Requirements article above.
   1. Products:
      a. Custom Building Products; Aqua Mix Enrich 'N' Seal: www.custombuildingproducts.com/#sle.
      b. Rust-Oleum Corporation; Miracle Sealants 511 H20 Plus: www.rustoleum.com/#sle.
      c. STONETECH, a division of LATICRETE International, Inc; STONETECH BulletProof Sealer: www.laticrete.com/#sle.

d. Substitutions: See Section 01 2500 - Substitution Procedures.

2.09 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/8 inch gap, minimum.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: Per manufacturer's written installation instructions.
      c. Products:
         1) TEC Specialty Products LLC; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
         2) LATICRETE International, Inc; LATICRETE FRACTURE BAN SC: www.laticrete.com/#sle.
         3) Mapei Corporation; Mapelastic CI: www.mapei.com/#sle.
         4) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
         5) Sika Corp; SikaTile 200 Fracture Guard Rapid: www.sika.com/#sle.
         6) Substitutions: Section 01 2500 - Substitution Procedures.

B. Waterproofing Membrane at Floors and Walls: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Crack Resistance: No failure at 1/16-inch gap, minimum; comply with ANSI A118.12.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: Per manufacturer's written installation instructions.
      c. Products:
         1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
         2) Mapei Corporation; Mapelastic AquaDefense: www.mapei.com/#sle.
         3) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 1: www.merkrete.com/#sle.
         4) Polycoat Products; Aquatight: www.polycoatusa.com/#sle.
         5) Sika Corp; SikaTile 100 Moisture Guard: www.sika.com/#sle.
         6) USG Corporation; Durock Brand Waterproofing Membrane: www.usg.com/#sle.
         7) Substitutions: See Section 01 2500 - Substitution Procedures.
   3. Bonded Sheet Membrane Type:
      a. Products:
         1) LATICRETE International, Inc; LATICRETE HYDRO BAN Sheet Membrane: www.laticrete.com/#sle.
         2) Mapei Corporation; Mapeguard WP 200 Membrane: www.mapei.com/#sle.
         3) Noble Company; NobleSeal TS: www.noblecompany.com/#sle.
         4) Schluter-Systems; KERDI: www.schluter.com/#sle.
         5) Substitutions: See Section 01 2500 - Substitution Procedures.

C. Metal Lath: ASTM C847 Flat diamond mesh, of weight to suit application, galvanized finish.

D. Backer Board: See Section 092116 - Gypsum Board Assemblies.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.

B. Verify wall surfaces are smooth and flat within tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Concrete Substrate Verification: Substrate moisture content and alkalinity to be confirmed by testing. See Section 090561 - Common Work Results for Flooring Preparation, for additional information.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Vacuum clean surfaces and damp clean.

B. Seal substrate surface cracks with filler.

C. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to feather edge.

D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install all components in accordance with manufacturer's written instructions and approved shop drawings.
   1. Do not exceed pot life of material as documented in writing by manufacturer.

B. Lay tile to pattern indicated on drawings. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install thresholds where indicated on drawings.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated on drawings. Use standard grout unless otherwise indicated on drawings.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 MOVEMENT JOINTS

A. Refer to TCNA (HB), section EJ171 "Movement Joint Guidelines for Ceramic, Glass, and Stone", for graphics and additional information.

B. Provide movement joints in each tile assembly to alleviate pressure from building movement, and reduce cracking of grout and tile. A movement joint substitutes grout for sealant, minimum 3/8 inch deep, installed on top of:
   1. Bond breaker tape, at thinset tile installations.
   2. Backer rod, at deeper mortarbed installations.

C. Locate movement joints:
   1. At each room perimeter, between floor tiles and wall material.
   2. Vertical inside wall corners.
   3. Exterior: Maximum 12 feet in each direction.
   4. Interior: Maximum 25 feet in each direction.
   5. Interior, exposed to direct sunlight: Maximum 12 feet in each direction.
   6. Above grade concrete slab: Maximum 12 feet in each direction.
   7. Change in floor finish material.
   8. Curbs.
   9. Ceilings.
   10. Change in substrate:
      a. Expansion joints.
      b. Control joints.
      c. Cold joints.
      d. Saw-cut joints.
      e. Isolation joints.

D. Provide continuous waterproof membrane below movement joints.

E. Movement Joint Width:
   1. Exterior, 8 foot on center: 3/8 inch.
   2. Exterior, 12 foot on center: 1/2 inch.
   3. Interior, at perimeter walls: 1/4 inch.
   4. Interior, other: Grout width, or 1/8 inch minimum.

3.05 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with high performance polymer modified grout, or as otherwise specified.

B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with high performance polymer modified grout, or as otherwise specified.
   1. Use uncoupling membrane under tile unless other underlayment is indicated on drawings.
   2. Where waterproofing membrane is indicated on drawings, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout, on ground.
   3. Where epoxy or furan grout is indicated on drawings, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F115.

3.06 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F101, bonded, with high performance polymer modified grout, unless otherwise specified.

B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated on drawings.
   1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F121, with high performance polymer modified grout, unless otherwise specified.
   2. Where epoxy or furan grout is indicated on drawings, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F114, with cleavage membrane.

C. Mortar Bed Thickness: 5/8 inch, unless otherwise indicated on drawings.

3.07 INSTALLATION - WALL TILE

A. On exterior walls, install in accordance with TCNA (HB) Method W244E, thin-set over cementitious backer units, with waterproofing membrane.

B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

C. Over interior concrete and masonry, install in accordance with TCNA (HB) Method W202I, thin-set with dry-set or latex-Portland cement bond coat.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Owner to engage a qualified testing agency to perform tests and inspections.
   1. Tile assemblies will be considered defective if they do not pass tests and inspections.
   2. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   3. Testing and inspecting agency to prepare reports and deliver to Owner or Contractor.
   4. Submit field quality control reports to Architect.

C. Tests:
   1. Slip-Resistance.
      a. Confirm the dynamic coefficient of friction (DCOF) meets or exceeds the value in Performance Requirements article above. Test to ANSI A326.3.
   2. Flood Testing.
      a. Flood test each waterproofed area for leaks, in accordance with manufacturer’s recommendations, after completing and protecting waterproofing but before overlaying construction is placed.
         1) After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

3.09 CLEANING

A. Clean tile and grout surfaces.

B. Seal tile, grout, and stone surfaces.

3.10 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 099113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior painting.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

F. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

G. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each item to be installed. Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. CAL (CDPH SM) compliance data.

D. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

2.02 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Benjamin Moore.
2. Dunn-Edwards.
3. Pittsburgh Paints (formerly PPG).
4. Sherwin-Williams.
5. Tnemec.
6. Substitutions: See Section 01 2500 - Substitution Procedures.

2.03 PAINTS AND FINISHES - GENERAL

A. Paint Colors:
   1. Products: See Finish Schedule on the Architectural drawings.
   2. P-1: (Manufacturer; Product, Color)

B. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

2.04 PAINT SYSTEMS - EXTERIOR

A. Paint WE-OP-3A - Wood, Opaque, Alkyd, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Gloss: Two coats of alkyd enamel.
   3. Semi-gloss: Two coats of alkyd enamel.

B. Paint CE-OP-3A - Concrete/Masonry, Opaque, Alkyd, 3 Coat:
   1. One coat of block filler.
   2. Semi-gloss: Two coats of alkyd enamel.
   3. Flat: Two coats of alkyd enamel.

C. Paint GE-OP-3L - Exterior Plaster, Opaque, Latex, 3 Coat:
   1. One coat of latex primer sealer.
   2. Flat: Two coats of latex.

D. Paint ME-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of alkyd primer.
   2. Gloss: Two coats of alkyd enamel.
   3. Semi-gloss: Two coats of alkyd enamel.

E. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
   1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
   2. Gloss: Two coats of alkyd enamel.
   3. Semi-gloss: Two coats of alkyd enamel.

F. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
   1. One coat galvanize primer.
   2. Gloss: Two coats of alkyd enamel.

3. Semi-gloss: Two coats of alkyd enamel.

G. Paint MaE-OP-3A - Aluminum, Unprimed, Alkyd, 3 Coat:
1. One coat etching primer.
2. Gloss: Two coats of alkyd enamel.
3. Semi-gloss: Two coats of alkyd enamel.

2.05 PRIMERS

A. Provide primer as recommended by manufacturer for substrate and conditions.

2.06 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Exterior Plaster and Stucco: 12 percent.
2. Fiber Cement Siding: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:
1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.

G. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

I. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

J. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

K. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

L. Copper: Remove contamination by steam, high pressure water, or solvent washing.

M. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

N. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

O. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

P. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

Q. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 099123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior painting.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

F. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

G. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system products to be used in project; include description of each system.
   4. Manufacturer's installation instructions.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. CAL (CDPH SM) compliance data.

D. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

2.02 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
   1. Benjamin Moore.
   2. Dunn-Edwards.
   3. Pittsburgh Paints (formerly PPG).
   4. Sherwin-Williams.
   5. Substitutions: See Section 01 2500 - Substitution Procedures.

2.03 PAINTS AND FINISHES - GENERAL

A. Paint Colors:
   1. Products: See Finish Schedule on the Architectural drawings.
   2. P-1: (Manufacturer; Product, Color)

B. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

2.04 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:
   1. One coat of latex primer sealer.
   2. Gloss: Two coats of latex enamel.
   3. Semi-gloss: Two coats of latex enamel.
   4. Eggshell: Two coats of latex enamel.
   5. Flat: Two coats of latex enamel.

B. Paint CI-OP-3A - Concrete/Masonry, Opaque, Alkyd, 3 Coat:
   1. One coat of block filler.
   2. Semi-gloss: Two coats of alkyd enamel.
   3. Flat: Two coats of alkyd enamel.

C. Paint MI-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of alkyd primer.
   2. Gloss: Two coats of alkyd enamel.
   3. Semi-gloss: Two coats of alkyd enamel.

D. Paint MI-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
   1. Touch-up with alkyd primer.
   2. Gloss: Two coats of alkyd enamel.
   3. Semi-gloss: Two coats of alkyd enamel.

E. Paint MgI-OP-3A - Galvanized Metals, Alkyd, 3 Coat:

1. One coat galvanize primer.
2. Gloss: Two coats of alkyd enamel.
3. Semi-gloss: Two coats of alkyd enamel.

F. Paint MaI-OP-3A - Aluminum, Unprimed, Alkyd, 3 Coat:
1. One coat etching primer.
2. Gloss: Two coats of alkyd enamel.
3. Semi-gloss: Two coats of alkyd enamel.

G. Paint CI-OP-3Af - Concrete/Masonry, Alkyd Floor Enamel, 3 Coat:
1. One coat of alkali-resistant primer.
2. Gloss: Two coats of alkyd floor enamel.

H. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
1. One coat of alkyd primer sealer.
2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.
4. Eggshell: Two coats of latex enamel.
5. Flat: Two coats of latex enamel.

2.05 PRIMERS

A. Provide primer as recommended by manufacturer for substrate and conditions.

2.06 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.

G. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.

H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

J. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high-alkali surfaces.

K. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

L. Copper: Remove contamination by steam, high-pressure water, or solvent washing.

M. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

N. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

O. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

P. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

Q. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

R. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood and metal surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 099600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

F. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

G. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2024.

H. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual Volume 2; 2021.

I. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024, with Errata (2025).

J. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

K. SSPC-SP 2 - Hand Tool Cleaning; 2024.

L. SSPC-SP 3 - Power Tool Cleaning; 2024.

M. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

N. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal; 2020.

O. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.

2. CAL (CDPH SM) compliance data.

D. Manufacturer's Certificate: Certify that high-performance coatings comply with VOC limits specified.

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

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include cleaning procedures and repair and patching techniques.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon of each type and color.
   2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.04 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum tenyears documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.06 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Restrict traffic from area where coating is being applied or is curing.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a one (1) year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

2.02 MANUFACTURERS

A. High-Performance Coatings:
   1. Dow.
   2. Dunn Edwards.
   3. ICI.
   4. Kelly-Moore.
   5. PPG.
   6. Precision Coatings.
   7. Rust-Oleum
   8. Sika.
   9. Sherwin-Williams.
   10. Tex-Cote (Tnemec).
   11. Tnemec.
   12. Substitutions: See Section 01 2500 - Substitution Procedures.

2.03 HIGH-PERFORMANCE COATINGS

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in MPI Approved Products List.

2.04 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
   1. Colors: As shown on the Architectural drawings, or as otherwise selected from manufacturer's full range.

B. Elastomeric Coating:
   1. Number of Coats: Two.
   2. Top Coat(s): Exterior Pigmented Elastomeric, Water Based; MPI #113. For exterior block and cement plaster.
      a. Sheen: Flat.
      b. Products:
         1) Dow; DOWSIL ALLGUARD Silicone Elastomeric Coating: www.dow.com/#sle.
         2) Pittsburgh Paints; Perma-Crete Pitt-Flex Elastomeric Coating, 4-110XI Series, Flat: www.pittsburghpaintsco.com/#sle. (MPI #113)
         3) Sika; Thorolastic-750.
         4) Tnemec Company, Inc; Series 156 Enviro-Crete: www.tnemec.com/#sle.
         5) Substitutions: See Section 01 2500 - Substitution Procedures.

C. Epoxy Coating:
   1. Number of coats: Two.

2. Top Coat(s): High Performance Institutional, Interior, Two-Component, Water Based Epoxy or Polyurethane Coating; MPI #252, #254, #255, #256.
    a. Sheen: Satin.
    b. Products:
        1) PPG Protective and Marine Coatings; Aquapon WB EP Two-Component Waterborne Epoxy, 98E-1/98E-100 Series, Semi-Gloss: www.ppgpmc.com/#sle.
        2) Rust-Oleum Corporation; Water-Based Epoxy Maintenance Coating - S60: www.rustoleum.com/#sle.
        3) Sherwin-Williams; Pro Industrial Water Based Catalyzed Epoxy: www.protective.sherwin-williams.com/#sle. (MPI #254)
        4) Vista Paint; Ure-Tech Int/Ext 2 Comp. Polyurethane.
        5) Substitutions: See Section 01 2500 - Substitution Procedures.

D. Urethane Coating:
1. Number of Coats: Two.
2. Product Characteristics:
    a. Dry film thickness, per coat: 2-3 mils, minimum.
3. Top Coat(s): Polyurethane, Solvent-Based, Two-Component; MPI #72, #174. For interior and exterior block, concrete, plaster, wood, and metal substrates.
    a. Sheen: Semi-Gloss.
    b. Products:
        1) Sherwin-Williams; Acrolon 218 HS: www.protective.sherwin-williams.com/#sle. (MPI #72, #174)
        2) Stonhard; Stonglaze VSE: www.stonhard.com/#sle.
        3) Tnemec Company, Inc; Series 1095 Endura-Shield: www.tnemec.com/#sle.
        4) Substitutions: See Section 01 2500 - Substitution Procedures.
4. Top Coat(s): Polyurethane, Water Based, Two-Component.
    a. Sheen: Satin.
    b. Products:
        1) PPG Protective and Marine Coatings; Amerishield VOC Polyester Acrylic Polyurethane, AMV-3 Series, Gloss: www.ppgpmc.com/#sle. (MPI #83)
        2) Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane, Low Sheen: www.protective.sherwin-williams.com/#sle. (MPI #157)
        3) Tnemec Company, Inc; Series 297 Enviro-Glaze: www.tnemec.com/#sle.
        4) Substitutions: See Section 01 2500 - Substitution Procedures.

E. Graffiti-Resistant Coating for Concrete:
1. Number of Coats: As recommended by manufacturer.
2. Top Coat: Polysiloxane hybrid coating.
    a. Color: Clear.
    b. Sheen: Satin.
    c. Products:
        1) RainguardPro; Micro-Seal with Graffiti Control Water Repellent / Anti-Graffiti: www.rainguardpro.com/#sle.
        2) Sherwin-Williams; Anti-Graffiti Coating.
        3) Tex-Cote (Tnemec); Graffiti Gard IV Clear.
        4) Substitutions: See Section 01 2500 - Substitution Procedures.

F. Fluoropolymer Coating for Exterior Metals:
1. Number of Coats: Two.
2. Top Coat(s): Air Dry Fluoropolymer, One or Two Component.
    a. Sheen: Gloss.

b. Finish: Metallic.
c. Products:
1) APV Engineered Coatings; NeverFade Original Restoration Topcoat: www.apvcoatings.com/#sle.
2) Arkema, Inc; Kynar Aquatec: www.arkema.com/#sle.
3) PPG Paints; Coraflon ADS: www.ppgpaints.com/#sle.
4) Tex-Cote LLC; Reflect-TEC Heat Reflective Roof & Wall Coating: www.texcote.com/#sle.
5) Tnemec Company, Inc; Series 1071V Fluoronar: www.tnemec.com/#sle.
6) Substitutions: See Section 01 2500 - Substitution Procedures.

G. Primers: As recommended by coating manufacturer for specific substrate, unless otherwise specified.

H. Shellac: Pure, white type.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
4. Concrete Floors and Traffic Surfaces: 8 percent.
5. Wood: Do not begin application if substrate has moisture content over 12 percent.

F. Proceed with coating application only after unacceptable conditions have been corrected.
1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

B. Clean surfaces of loose foreign matter.

C. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

D. Remove finish hardware, fixture covers, and accessories and store.

E. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Prepare surface as recommended by coating manufacturer and in accordance with SSPC-SP 13/NACE No.6.

F. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by coating manufacturer.

G. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3, and protect from corrosion until coated.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete: Prior to priming, patch with masonry filler to produce smooth surface.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 099620
PERMANENT NON-SACRIFICIAL ANTI-GRAFFITI COATING

PART 1 - GENERAL

1.01 **SECTION INCLUDES**

A. Anti-graffiti coating systems vertical surfaces for cast stone, brick masonry, concrete unit masonry (painted and unpainted), cast-in-place building concrete, cast-in-place site concrete, and architectural site concrete..

B. Surface preparation

C. field application

1.02 RELATED SECTIONS INCLUDE THE FOLLOWING:

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 099000 - Painting and Coating.

C. Section 033000 - Cast-in-Place Concrete; Bulidng concrete

D. Section 042000 - Unit Masonry; Concrete unit masonry construction.

E. Section 079005 - Joint Sealers; Joint sealants.

F. Section 323300 - Architectural Site Concrete

1.03 REGULATORY REQUIREMENTS

A. California Air Resources Board, Volatile Organic Compound (VOC) Limitation: Provide anti-graffiti coating materials, including primers, undercoats, and finish-coat materials, that have a VOC content of 100 g/l or less, consistent with Southern California Air Quality Management District (SCAQMD) Rule 1113 for architectural flat coatings.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials and installation recommendations.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

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

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon of each type and color.
   2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.06 MOCK-UP

A. Apply Sealer and Anti-graffiti coating to approved Architectural Site Concrete Mock-ups for review and approval by Architect and client prior to beginning work.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within one year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Products: The design for each non-sacrificial anti-graffiti coating system is based on the products indicated.

B. Type 2, Silane/Siloxane-Based Systems:
   1. Rainguard International Inc., VandlGuardTEN non-sacrificial Anti-Graffiti System.
      a. Sealer; Product Micro-Seal Water Repellant.
      b. Non-Sacrificial Coating; Product VandlGuardTEN
      c. Finish Coat; Product VandlGuard Finish Coat.

2.02 PERFORMANCE REQUIREMENTS

A. General: Non-sacrificial anti-graffiti coating system with the following properties:
   1. Superior protection against, and easy removal of, unwanted graffiti.
   2. Minimum alteration of appearance of treated surface when compared to untreated surface, including gloss and color.
   3. Minimum alteration of water vapor transmission rate through complete wall system.
      a. Coating system shall have a minimum water vapor transmission rate of 95 percent when tested per ASTM D1653.

B. Completed coating system performance shall comply with ASTM D 6578 “Standard Practice for Determination of Graffiti Resistance,” and the following:
   1. Cleanability Level 3: Achieve Level 3 cleaning performance, removing all test graffiti items using citrus-based cleaners or milder solvents.

C. Apply to all exposed surfaces of site architectural concrete vertical surfaces.
   1. Cast in place concrete.
   2. Concrete masonry units.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which anti-graffiti coatings will be applied, for compliance with coating application requirements.

B. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.

3.02 PREPARATION

A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item; provide surface-applied protection before surface preparation and coating.
   1. After completing coating operations, reinstall items that were removed, using workers skilled in the trades involved.

B. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.
   1. Prepare concrete, brick, unit masonry, and cast stone to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
   2. Surfaces to receive sealer shall be cleaned of dirt, oil, graffiti, grease, laitance, and other contaminants.
   3. Mid-pressure water (1500 psi) washing is the minimum cleaning that will be accepted, other methods, such as abrasive blasting and power may be submitted for review.
   4. Schedule cleaning and coating application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces.

C. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
   2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application.
   3. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
   4. Use only the type of thinners approved by manufacturer and only within recommended limits.

D. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of coating system components. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of components being deposited on surfaces. Cover live plants and grass.

E. Coordination with Sealants: Do not apply anti-graffiti coatings until sealants for joints adjacent to surfaces receiving coatings have been installed and cured.
   1. Anti-graffiti coating work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, anti-graffiti coatings, and sealant materials identical to those used in the work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 APPLICATION

A. General: Apply anti-graffiti coatings according to manufacturer's written instructions.
   1. Use applicators and techniques best suited for the material being applied.

2. Do not apply anti-graffiti coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating surface treatments and finishes are indicated in the coating system descriptions.
4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, drinking fountains, grilles, covers for electrical equipment, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

B. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces.
1. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.

C. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

D. The number of coats and film thickness required is the same regardless of application method.
1. Micro-Seal- one (1) coat
2. VandlGuard TEN- two (2) coats
3. VandlGuard Finish Coat- one (1) coat

E. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. Allow sufficient time between successive coats to permit proper drying.

F. Give special attention to edges, corners, crevices, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

G. Application Procedures: Apply coatings according to manufacturer's written instructions.
1. Spray Equipment: Use spray equipment with pressure and orifice size recommended by manufacturer for material and texture required.

H. Minimum Coating Thickness: Apply each material no thinner than manufacturers recommended spreading rate.
1. Provide total dry film thickness of the entire system as recommended by manufacturer.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.

J. Recoat primed and sealed substrates immediately if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn -through or other defects caused by insufficient sealing.

K. Completed Work: Match accepted mockups for shade and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.04 FIELD QUALITY CONTROL

A. Provide the services of the manufacturer's authorized field representative to verify that installed products comply with manufacturer's requirements and with the standard established by the Architect approved mockup/test panels.

B. Remove and replace work where test results indicate that it does not comply with specified requirements.

3.05 CLEANING

A. Immediately clean anti-graffiti coatings from adjoining surfaces and surfaces soiled or damaged by application as work progresses. Repair damage caused by application. Comply with manufacturer's written cleaning instructions.

B. Clean up debris and unused material and remove from site.

3.06 PROTECTION

A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

END OF SECTION

SECTION 101423
PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signage.

1.02 REFERENCE STANDARDS

A. ABA Standards - ABA Accessibility Standards; 2004, with Amendments (2015).
B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers; 2017.
D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: For each item to be installed. Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
    1. VOC content restrictions data.
    2. CAL (CDPH SM) compliance data.
    3. Life cycle data.
    4. Recycled content data.
D. Shop Drawings:
    1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
E. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.
F. Verification Samples: Submit samples showing colors, materials, and finishes specified.
G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
H. Manufacturer's qualification statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.
B. Package signs as required to prevent damage before installation.
C. Store under cover and elevated above grade.

D. Store tape adhesive at normal room temperature.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.06 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

D. Life Cycle: Products in this section to have LCA as specified in Section 016000.

E. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.02 REGULATORY REQUIREMENTS

A. See Section 014100 - Regulatory Requirements.

B. Accessibility: Comply with applicable provisions in the ADA Standards, ABA Standards, and ICC A117.1.

2.03 MANUFACTURERS

A. Panel Signage Manufacturers:
   1. Accent Signage Systems.
   2. ADA Sign Depot.
   3. Apco Signs.
   4. Best Sign Systems.
   5. FastSigns.
   6. Inpro.
   7. Substitutions: See Section 01 2500 - Substitution Procedures.

2.04 PANEL SIGNAGE

A. Panel Signage:
   1. Application: Room and door signs.
   2. Configuration and Materials: Refer to Architectural drawings.
   3. Description: Flat signs with engraved panel media, tactile characters.
   4. Sign Size: As indicated on drawings.
   5. Tactile Letters: Raised 1/32 inch minimum.

6. Braille: Grade II, ADA-compliant.

2.05 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

B. Tape Adhesive: Double-sided tape, permanent adhesive.

2.06 FINISH

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

B. Install with horizontal edges level.

C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

3.03 PROTECTION

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements.

B. Provide barrier or other delineation to prevent damage to installed Work from subsequent construction activities.

END OF SECTION

SECTION 102113.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Solid surface toilet compartments.

1.02 REFERENCE STANDARDS

A. ABA Standards - ABA Accessibility Standards; 2004, with Amendments (2015).

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2024b.

D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

E. ASTM A743/A743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application; 2021.

F. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

J. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

K. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers; 2017.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

N. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

O. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work with placement of support framing and anchors in walls and ceilings.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: For each item to be installed.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.
   2. CAL (CDPH SM) compliance data.
   3. Life cycle data.
   4. Recycled content data.

D. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, and door swings.

E. Samples: Submit two samples of partition panels, 6 by 6 inches or otherwise in manufacturer's size, illustrating panel finish, color, and sheen.

F. Manufacturer's installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements for packaging waste requirements.

B. Deliver, store, and handle materials and products in accordance with manufacturer's instructions and recommendations and industry standards.

C. Do not deliver materials or begin installation until building is enclosed, with complete protection from outside weather, and building temperature maintained at minimum of 60 degrees F.

D. Store products indoors in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect products from damage.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.06 FIELD CONDITIONS

A. Ambient Conditions: Maintain environmental conditions, such as temperature, humidity, and ventilation, within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify actual dimensions by field measurement before fabrication. Show recorded measurements on shop drawings.

1.07 WARRANTY

A. See Section 01 6000 - Product Requirements for additional warranty requirements.

B. Provide manufacturer's standard warranty for each product.

1.08 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing.

C. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location.

D. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.09 WARRANTY

A. See Section 01 6000 - Product Requirements and Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's standard warranty for each product.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

D. Life Cycle: Products in this section to have LCA as specified in Section 016000.

E. Recycled Content: Products in this Section to meet minimum recycled content thresholds specified in Section 016000.

2.02 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Surface Burning Characteristics: Flame spread index of 26 to 75 and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:
   1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf. applied at any direction and at any point, without deformation of panel.

2.03 REGULATORY REQUIREMENTS

A. Accessibility: Comply with applicable provisions in the ADA Standards, ABA Standards, and ICC A117.1.

B. California:
   1. Accessible Toilet Compartments: CBC Section 11B-604.
   2. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
      a. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Section and Figure 11B-604.8.1.4. It shall be 9 inches high minimum above the finish floor and 6 inches deep minimum beyond the compartment side face of the partition, exclusive of partition support members. It shall be 12 inches high minimum above the finish floor for children's use. Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces. Toe clearances at the side partition is not required in a compartment greater than 66 inches wide.
      b. An ambulatory accessible compartment shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets totals six or more per CBC Section 11B-213.3.1. Such compartment shall comply with CBC Section 11B-604.8.2.
      c. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Section 11B-404 except that pull-side clearance for ambulatory accessible compartments shall be a minimum of 44 inches clear, rather than 60 inches. CBC Figure 11B-604.8.2.

d. A door pulll complying with CBC Seection 11B-404.2.7 shall be placed on both sides of the door near the latch.
e. Doors shall not swing into clear floor space or clearance requied for any fixtures.
f. Install coat hook at 48 inches maximum above finished floor.

2.04 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
1. Accurate Partitions.
2. Ampco.
3. ASI Accurate.
4. Bobrick
5. Hadrian.
6. Inpro.
7. Scranton Products.
8. Substitutions: See Section 01 2500 - Substitution Procedures.

B. Solid Surface Toilet Compartments:
1. DuPont Corian.
2. Inpro.
3. Substitutions: See Section 01 2500 - Substitution Procedures.

2.05 SOLID PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286 and graffiti-resistant.
1. Basis of Design Product:
a. See Restroom Accessories Schedule on the Architectural drawings.
b. Substitutions: See Section 01 2500 - Substitution Procedures.
2. Basis of Design Product:
a. Bobrick; SierraSeries SCRC.
b. Substitutions: See Section 01 2500 - Substitution Procedures.
3. Color: As selected by Architect.

B. Mounting and Configuration: As shown on the Architectural drawings.

C. Privacy: Gap-free doors and stiles.

D. Doors:
1. Thickness: 1 inch.
2. Accessible Width: 36 inch, out-swinging.

E. Panels:
1. Thickness: 1 inch.

F. Pilasters:
1. Thickness: 1 inch.
2. Width: As required to fit space; minimum 3 inches.

2.06 SOLID SURFACE TOILET COMPARTMENTS

A. Solid Surface Toilet Compartments: Factory-fabricated doors, pilasters, and divider panels made of acrylic polymer resin, mineral filler, and pigment; complying with ISFA 2-01 and NEMA LD 3.
1. Basis of Design Product:
a. See Restroom Accessories Schedule on the Architectural drawings.

b. Substitutions: See Section 01 2500 - Substitution Procedures.

2. Products:
   a. DuPont Corian; Privacy Plus Partitions.
   b. Inpro; Prism Solid Surface Toilet Compartments.
   c. Substitutions: See Section 01 2500 - Substitution Procedures.
3. Finish: As selected by Architect from manufacturer's full range.

B. Mounting and Configuration: As shown on the Architectural drawings.

C. Privacy: Gap-free doors and stiles.

D. Doors:
1. Thickness: 1 inch.
2. Accessible Width: 36 inches, outswinging.
3. Height: 55 inches.

E. Panels:
1. Thickness: 1/2 inch.
2. Height: 55 inches.

F. Pilasters:
1. Thickness: 1 inch.
2. Width: As required to fit space; minimum 3 inches.

2.07 FABRICATION

A. Fabricate toilet compartment components to sizes indicated in shop drawings.

B. Coordinate requirements and provide cutouts for through-partition toilet accessories.

C. Provide shoes and caps at pilasters and posts to conceal anchorage, supports, and leveling mechanisms.

D. Provide manufacturer's standard corrosion-resistant supports, leveling mechanisms, anchors, and anchoring assemblies for pilasters and posts.

E. Floor-Anchored, Overhead-Braced Units: Provide supports, leveling mechanisms, and anchors at pilasters to suit floor conditions.

F. Ceiling-Hung Units:
1. Provide anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural steel support, with two adjustable hanging studs above finished ceiling.
2. Provide assemblies that support pilasters from structural steel without transmitting load to finished ceiling.

G. Floor-and-Ceiling-Anchored Units: Provide anchoring assemblies with leveling adjustment at tops and bottoms of pilasters.

2.08 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M).

C. Stainless Steel Sheet, Plate, and Bar: ASTM A240/A240M or ASTM A666/A666M, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

2.09 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.

1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

C. H channel for full-height divider panels, where shown on the Architectural drawings.

D. Attachments, Screws, and Bolts: Stainless steel, tamper-proof type.

E. Hinges:
1. Continuous-type hinge, self-closing.

F. Door Hardware:
1. Door Latch: Slide type with exterior emergency access feature.
2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
3. Provide door pull for outswinging doors.
4. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify spacing of and between plumbing fixtures.

C. Verify location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's written instructions and approved shop drawing.

B. Maintain 3/8-to-1/2-inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate headrail joints at pilaster center lines.

E. Replace damaged or scratched materials with new materials. Do not touch up scratches or damaged finish in field.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch.

B. Maximum Variation from Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partially open position when unlatched. Return outswinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Under-lavatory pipe supply covers.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2024.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

F. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

G. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings; 2023.

H. ASTM C1036 - Standard Specification for Flat Glass; 2025.

I. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

J. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.

K. ASTM D4802 - Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet; 2016.

L. ASTM D5047 - Standard Specification for Polyethylene Terephthalate Film and Sheeting; 2017.

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

O. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

P. CBC 11B- Accessible code requirements; CBC 11B-308 - Reach Ranges; California Building Code.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each item to be installed. Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing.

C. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location.

D. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.06 WARRANTY

A. See Section 01 6000 - Product Requirements and Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's standard warranty for each product.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. California:
   1. Sanitary Facility Elements: CBC Section 11B-602 through 11B-612
   2. Elements of sanitary facilities shall be mounted at locations in compliance with CBC Sections 11B-602 through 11B-612.
   3. Grab bars on toilet facilities and bathing facilities shall comply with CBC Section 11B-609. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges. The space around the grab bars shall be as follows:
      a. 1-1/2 inches between the grab bar and the wall.
      b. 1-1/2 inches minimum between the grab bar and projecting objects below and at the ends.
      c. 12 inches minimum between the grab bar and projecting objects above.
   4. Toilet paper dispensers shall be continuous flow type.

2.02 MANUFACTURERS

A. Commercial Toilet Accessories:
   1. AJW.
   2. American Specialties, Inc. (ASI).
   3. Bobrick.

4. Bradley.
5. Georgia-Pacific Professional.
6. Seachrome.
7. Substitutions: See Section 01 2500 - Substitution Procedures.

B. Under-Lavatory Pipe Supply Covers:
1. Plumberex Specialty Products, Inc.
2. Truebro (IPS Corporation).
3. Substitutions: See Section 01 2500 - Substitution Procedures.

C. Provide products of each category type by single manufacturer.

2.03 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
1. Grind welded joints smooth.
2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide 2 keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Zinc Alloy: Die cast, ASTM B86.

G. Acrylic Plastic Sheet: ASTM D4802.

H. PETG Plastic Sheet: ASTM D5047.

I. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

J. Adhesive: Two component epoxy type, waterproof.

K. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

L. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.04 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

C. Back paint components where contact is made with building finishes to prevent electrolysis.

2.05 COMMERCIAL TOILET ACCESSORIES

A. Products: See Restroom Accessories Schedule on the Architectural drawings.

B. Toilet Paper Dispenser: Double roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
1. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

C. Toilet Paper Dispenser: Double roll, surface mounted, for cored or coreless type rolls.
1. Basis of Design Product:

a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

D. Combination Toilet Paper /Seat Cover Dispenser: Double roll; Recessed flush with wall, stainless steel; seamless wall flanges, continuous piano hinges.
1. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

E. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
1. Capacity: 500 multifold minimum.
2. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

F. Paper Towel Dispenser: Manual, roll paper type.
1. Material: Stainless steel.
2. Paper Discharge: Manual dispense by lever operation.
3. Capacity: 8-inch diameter roll.
4. Mounting: Surface mounted.
5. Refill Indicator: Transparent viewing slot.
6. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

G. Paper Towel Dispenser: Electric, roll paper type.
1. Material: Stainless steel.
2. Paper Discharge: Touchless automatic.
3. Capacity: 8 inch diameter roll.
4. Mounting: Surface mounted.
5. Power: Battery operated.
6. Refill Indicator: Transparent viewing slot.
7. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

H. Waste Receptacle: Stainless steel, freestanding style.
1. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

I. Waste Receptacle: Recessed, stainless steel, seamless lower door for access to container, with tumbler lock, reinforced panel full height of door, push-in self-closing top door, continuously welded bottom pan and seamless exposed flanges.
1. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

J. Combination Towel Dispenser / Waste Receptacle: Recessed flush with wall, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
1. Waste receptacle liner: Reusable, heavy-duty vinyl.
2. Towel dispenser capacity: 400 C-fold.
3. Waste receptacle capacity: 4 gallons.
4. Basis of Design Product:
a. Bobrick;

b. Substitutions: See Section 01 2500 - Substitution Procedures.

K. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
1. Minimum Capacity: 48 ounces.
2. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

L. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
1. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

M. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base, tumbler lock.
1. Minimum capacity: 250 seat covers.
2. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

N. Grab Bars: Stainless steel, smooth surface.
1. Standard Duty Grab Bars:
a. Push/Pull Point Load: 250 pound-force, minimum.
b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
c. Length and Configuration: As indicated on drawings.
d. Basis of Design Product:
1) Bobrick;
2) Substitutions: See Section 01 2500 - Substitution Procedures.

O. Combination Sanitary Napkin / Tampon Dispenser with Disposal: Stainless steel, surface-mounted.
1. Door: Seamless 0.05 inch door with returned edges and tumbler lock.
2. Cabinet: Fully welded, 0.03 inch thick sheet.
3. Operation: No charge; no coin slots.
4. Operation: 25 cent coin required to operate dispenser. Provide locked coin box, separately keyed.
5. Minimum capacity: 15 napkins and 20 tampons.
6. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

P. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Basis of Design Product:
a. Bobrick;
b. Substitutions: See Section 01 2500 - Substitution Procedures.

2.06 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:
1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.

3. Construction: 1/8 inch flexible PVC.
    a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
    b. Comply with ASTM C1822, type indicated.
    c. Comply with ASME A112.18.9.
    d. Comply with ICC A117.1.
    e. Microbial and Fungal Resistance: Comply with ASTM G21.
4. Color: White.
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As shown on the Architectural drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 116813
PLAYGROUND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Playground equipment.

B. Location of each item of playground equipment is indicated on drawings.

1.02 RELATED REQUIREMENTS

A. Section 312200 - Grading: Shaping subgrade to specified grade levels.

B. Section 321816.13 - Playground Protective Surfacing: Protective surfacing in playground area.

1.03 DEFINITIONS

A. Play Event: A piece of playground equipment that supports one or more play activities.

B. Use Zone: Area under and around a play event within which the ground surfacing must meet fall impact attenuation requirements of ASTM F1292 when tested at the fall height specified for the play event.

C. Fall Height: Vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it, as defined in ASTM F1487.

D. Protective Surfacing: Resilient ground surfacing, specified in Section 32 1816.13. The characteristics of the protective surfacing are based on the fall height of the playground equipment. Changes in either the surfacing or the fall height, particularly reducing the resilience of the protective surfacing or increasing the fall height, will reduce safety-related performance.

E. Subgrade: Surface of the ground on which the protective surfacing is installed; the subbase for the protective surfacing is installed over the subgrade.

1.04 REFERENCE STANDARDS

A. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

B. ASTM F1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment; 2022.

C. ASTM F1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use; 2021.

D. CPSC Pub. No. 325 - Public Playground Safety Handbook; 2015.

E. California Building Code (CBC) 2025; Sections 11B-240 and 11B-1008

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Convene a meeting one week before starting earthwork for playground to discuss coordination between various installers.

1. Require attendance by personnel responsible for grading and installers of playground equipment, protective surfacing, footings, and adjacent work.
2. Include representatives of Contractor.
3. Notify Architect at least 2 weeks prior to meeting.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: For manufactured equipment, provide manufacturer's product data showing materials of construction, compliance with specified standards, installation procedures, safety limitations, and the number of users permitted.

C. Shop Drawings: Detailed scale drawings showing play event layout, use zone perimeters, and fall height for each play event.
   1. Show locations and dimensions of footings and anchorage points.
   2. Show locations of underground utilities, storm drainage system and irrigation system.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

F. Maintenance Data: Provide manufacturer's recommended maintenance instructions and list of replaceable parts for each equipment item, with address and phone number of source of supply.

G. Executed warranty.

1.07 QUALITY ASSURANCE

A. Maintain one copy of the latest edition of ASTM F1487 and CPSC Pub. No. 325 at project site.

B. Safety performance specifications for play component shall comply with **ASTM F 1487-01.**

C. Playground equipment shall comply with **11B-1008.**

D. Manufacturer Qualifications: Company regularly engaged in manufacturing materials and products specified in this section, with at least five years of documented experience.
   1. Provide documentation showing that playground equipment similar to that specified has been installed in at least sites and in successful service for at least years; provide addresses.
   2. Provide certificate of Insurance AA rated for minimum 1,000,000 dollars covering both product and general liability.

E. Installer Qualifications: Company certified by manufacturer for training and experience installing play events and equipment.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store equipment to project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, elevated above grade.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Playground Equipment:
   1. Columbia Cascade:1-800-547-1940. https://www.columbia-cascade.com/
   2. Earthscape Play Inc.: https://www.earthscapeplay.com/
   3. Kompan: 1-800-426-9788.; https://www.kompan.com/en/us

2.02 PLAYGROUND EQUIPMENT - GENERAL

A. Design Assumptions: Because the safety of the playground depends on strict compliance with design criteria, this information is provided for Contractor's information.
   1. Playground has been designed for children ages 2 through 5.
   2. If deviations from specified dimensions, especially fall heights, is required, obtain approval prior to proceeding; follow approval request procedure as specified for substitutions.

B. Mount equipment on concrete footings, unless otherwise indicated.
   1. Protective Surfacing Depth: As indicated on drawings.
   2. Provide supports as required to mount equipment at proper height above finish and sub-grades to allow installation of sufficient depth of protective surfacing; portion of support below top of surfacing must comply with specified requirements for equipment.
   3. Paint portion of support that is intended to be installed below top surface of protective surfacing a different color, or mark in other permanent way, so that installers and maintainers of protective surfacing can easily determine whether sufficient depth has been installed.

C. Provide permanent label for each equipment item stating age group that equipment was designed for, manufacturer identification, and warning labels in accordance with ASTM F1487.

2.03 PLAYGROUND EQUIPMENT

A. Comply with ASTM F1487 and CPSC Pub. No. 325; provide equipment complying with specified requirements for relevant age group(s).
   1. Provide components having factory-drilled holes; do not use components with extra holes that will not be filled by hardware or covered by other components.

B. Wood Walking:
   1. Location:
   2. Construction: Stationary wood timber, anchored firmly to ground or support posts.
   3. Certification: Provide International Play Equipment Manufacturers Association (IPEMA) certification that indicates product complies with ASTM F1487, excluding sections 7.1.1, 10, and 12.6.1.
   4. Manufacturers:
      a. As noted on sheet L0.01 in Play Equipment Legend.

C. Single-Axis (To-and-Fro) Swings: Single-user swings seats suspended from steel chains.
   1. Location:
   2. Seats - Ages Five to Twelve: Standard swing seat molded of rubber or polyurethane with encapsulated steel reinforcement. Provide swings for each swing bay.
   3. Swing Support Structure: As indicated on drawings; wood and stainless steel..
   4. Certification: Provide International Play Equipment Manufacturers Association (IPEMA) certification that indicates product complies with ASTM F1487, excluding sections 7.1.1, 10, and 12.6.1.
   5. Manufacturers:
      a. As noted on sheet L0.01 in Play Equipment Legend.

D. Slides: (Embankment)
   1. Location: As indicated on drawings.
   2. Slide Bed: Rigid, Stainless steel _____.
   3. Treads and Handrails: Solid wood with stringers of wood.
   4. Maximum Slope: 1:5.1.
   5. Supports and Platform: Galvanized steel with powder coating.
   6. Color: As indicated on drawings.

7. Certification: Provide International Play Equipment Manufacturers Association (IPEMA) certification that indicates product complies with ASTM F1487, excluding sections 7.1.1, 10, and 12.6.1.
8. Manufacturers:
   a. As noted on sheet L0.01 in Play Equipment Legend..

E. Inclined Monkey Bars:
1. Location:
2. Certification: Provide International Play Equipment Manufacturers Association (IPEMA) certification that indicates product complies with ASTM F1487, excluding sections 7.1.1, 10, and 12.6.1.
3. Manufacturers:
   a. As noted on sheet L0.01 in Play Equipment Legend.

F. Rope Climber: (Spider Web)
1. Location:
2. Certification: Provide International Play Equipment Manufacturers Association (IPEMA) certification that indicates product complies with ASTM F1487, excluding sections 7.1.1, 10, and 12.6.1.
3. Manufacturers:
   a. As noted on sheet L0.01 in Play Equipment Legend._____.

G. Single Hammock
1. Location: As indicated on drawings.
2. Certification: Provide International Play Equipment Manufacturers Association (IPEMA) certification that indicates product complies with ASTM F1487, excluding sections 7.1.1, 10, and 12.6.1.
3. Manufacturers:
   a. As noted on sheet L0.01 in Play Equipment Legend.

2.04 MATERIALS

A. Rope Cable:
1. Strands of steel cable with UV-stabilized synthetic covering; ends capped to prevent fraying.
2. Strands of natural fibers with UV-stabilized [____] synthetic covering; ends capped to prevent fraying.

B. Hardware: Provide without hazardous protrusions, corners, or finishes, and that require tools for removal after installation; countersunk fasteners are preferred.
1. Use stainless steel for metal-to-metal connections; select type to minimize galvanic corrosion of materials connected by hardware.
2. Use stainless steel for wood-to-wood and wood-to-metal connections.
3. Use stainless steel with plastic components.
4. Bearings: Self lubricating.
5. Hooks, Including S-Hooks: Closed loop; maximum gap 0.04 inches, less than the thickness of a dime.
6. Rails, Loops, and Hand Bars: Same metal as item is mounted on or wood.
7. Anchors: In accordance with manufacturer's recommendations.

C. Boards and Timbers: Free of holes, cracks, and loose knots; do not use wood or wood coatings that contain pesticides.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that playground equipment footings have been installed in proper locations and at proper elevations.

B. Verify location of underground utilities and facilities in playground area; damage to underground utilities and facilities will be repaired at Contractor's expense.

3.02 PREPARATION

A. Stake location of playground elements, including Use Zone perimeters, perimeter of protective surfacing, access and egress points, hard surfaces, walls, fences, and structures, and planting locations.

B. Stake layout of entire Use Zone perimeter before starting any work.
   1. Verify that Use Zone perimeters do not overlap hard surfaces, whether currently installed or not.
   2. Verify that Use Zones are free of obstructions that would extend into protective surfacing.
   3. If conflicts or obstructions exist, notify Architect.
   4. Do not proceed until revised drawings have been provided, showing corrected layout, and obstructions have been removed.

3.03 INSTALLATION

A. Coordinate work with preparation for and installation of protective surfacing specified in Section 321816.13; install _____ protective surfacing after playground equipment installation.

B. Install in accordance with CPSC Pub. No. 325, ASTM F1487, manufacturer's instructions, and requirements of authorities having jurisdiction (AHJ).

C. Anchor equipment securely below bottom elevation of resilient surfacing layer.

D. Install without sharp points, edges or protrusions, entanglement hazards, pinch, crush, or shear points.

E. Do not modify play events on site without written approval of manufacturer.

F. Install required signage if not factory-installed.

3.04 FIELD QUALITY CONTROL

A. Obtain the services of the equipment manufacturer's field representative to review the finished installation for compliance with specified requirements and with design criteria to the extent known to the Contractor; submit report of field review.

B. Owner or Owner's representative will inspect playground equipment after installation to verify that playground meets specified design safety and accessibility requirements.

C. Repair or replace rejected work until compliance is achieved.

3.05 CLEANING

A. Restore adjacent existing areas that have been damaged from the construction.

B. Clean playground equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation; clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

C. Clean playground area of excess construction materials, debris, and waste.

D. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction (AHJ).

3.06 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 116833
ATHLETIC FIELD EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outdoor basketball equipment.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Footings for field equipment.
B. Section 099113 - Exterior Painting.
C. Section 312200 - Grading: Shaping subgrade to specified grade levels.

1.03 ABBREVIATIONS

A. FIFA - Federation Internationale de Football Association; www.fifa.com.
B. NCAA - National Collegiate Athletic Association; www.ncaa.org.
C. NFHS - National Federation of State High School Associations; www.nfhs.com and www.nfhs.org.
D. U.S. CPSC - United States Consumer Product Safety Commission; www.cpsc.gov.
E. USFHA - United States Field Hockey Association; www.teamusa.org/USA-Field-Hockey.

1.04 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.
C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
D. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing; 2025.
E. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.
F. ASTM B108/B108M - Standard Specification for Aluminum-Alloy Permanent Mold Castings; 2019.
G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.
J. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position; 2018.
K. ASTM D6662 - Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards; 2022.

L. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Convene a meeting one week before starting this work to discuss coordination between various installers.
   1. Require attendance by personnel responsible for grading and installers of athletic field equipment, footings, and adjacent work.
   2. Include representatives of Contractor.
   3. Notify Architect at least two weeks prior to meeting.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide athletic field equipment manufacturer's product data indicating materials of construction, compliance with specified standards, installation procedures, and necessary safety limitations.

C. Shop Drawings: Submit detailed scale drawings showing athletic field equipment and perimeter layout.
   1. Indicate locations and dimensions of footings and anchorage points.
   2. Identify mounting elevations in relation to fixed survey point on site, and subgrade elevation.
   3. Indicate location of underground utilities, storm drainage system, and irrigation system.
   4. Indicate location of related construction such as walkways and roadways, fences, _____, and site furnishings.

D. Maintenance Data: Submit manufacturer's recommended maintenance instructions and list of replaceable parts for each athletic field equipment item, along with supplier's address and phone number.

E. Installer's Qualification Statement.

F. Executed Warranty.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store equipment on project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, and elevated above grade.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum ____ year manufacturer warranty for _____ athletic field equipment. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Athletic Field Equipment:
   1. Gill Athletics, (800) 637-3090
   2. UCS, (800) 526-4856.
   3. _____.
   4. Sportsfield Specialties, (888) 975-3343

2.02 ATHLETIC FIELD EQUIPMENT - GENERAL

A. Mount supporting posts in concrete footings, unless otherwise indicated, refer to Section 033000 for additional concrete footing installation requirements.

B. Coordinate field grading as required for proper placement and arrangement of equipment, refer to Section 312200 for additional information.

C. Safety and Warning Signage: Provide signage as indicated on drawings and required by authorities having jurisdiction.

2.03 OUTDOOR BASKETBALL EQUIPMENT

A. Manufacturers:
   1. LA SteelCraft, (866) 210-5262

B. Outdoor Basketball Support Post: Powder coated steel support post, with 4-1/2 inch outside diameter.
   1. Straight style horizontal arm with 4 feet extension attached to support post with sliding collar type connection providing height adjustment full length of support post.
   2. Cap top of post to protect from weather.
   3. Anchor post in concrete footing; provide lug in support post to prevent rotation in footing.
   4. Model No.: Refer to Sports Equipment Legend on sheet L0.01.

C. Backboard: Anchored to support post or extension arms.
   1. Color and Finish: Orange with powder coat finish, with contrast colored target and border lines.
   2. Model No.: Refer to Sports Equipment Legend on sheet L0.01.

D. Goal: Anchored to mounting plate through backboard to support post or extension arms.
   1. Color and Finish: Orange powder coat.
   2. Chain Net: Zinc plated metal with small loop chain net attached with S-hooks.

E. Goal Post Pads: Provide padding for 6 inch round post consisting of 1-1/2 inch thick polyethylene foam with weather resistant lace and grommet attachment and vinyl cover; 7 feet high.

2.04 MATERIALS

A. Steel Pipe and Tube: Complying with ASTM A135/A135M, ASTM A500/A500M, or ASTM A513/A513M; hot-dip galvanized and free of excess weld and spatter.
   1. Tensile Strength: 45,000 psi, minimum.
   2. Yield Point: 33,000 psi, minimum.
   3. Galvanizing: Hot-dip metal components in zinc after fabrication, in accordance with ASTM A123/A123M; remove tailings and sharp protrusions and burnish edges.

B. Chain: Corrosion resistant zinc plated steel; minimum size 4/0; polyvinyl chloride (PVC) coating.

C. Powder Coating for Steel: Electrostatically applied and oven cured polyester powder over electrostatic zinc coating.

D. Polyvinyl Chloride (PVC) Coating: Ultraviolet (UV) stabilized and mold-resistant; slip-resistant finish; prime coated parts with clear acrylic thermosetting solution and ensure they are preheated prior to dipping in liquid PVC.
   1. Thickness: 0.08 inch, minimum, plus/minus 0.02 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that athletic field equipment area has been graded to subgrade elevations required and that excess soil, rocks, and debris has been removed as necessary for installation of footings.

3.02 PREPARATION

A. Stake location of athletic field equipment elements, including necessary athletic field perimeters, surfacing, access and egress points, hard surfaces, walls, fences, _____, and/or structures.

B. Stake layout of athletic field equipment perimeter in accordance with approved shop drawings before starting any work.
   1. Verify that athletic field perimeters do not overlap hard surfaces, whether currently installed or not.
   2. Verify that athletic fields are free of obstructions.
   3. If conflicts or obstructions are found, notify Architect.
   4. Do not proceed with this work until revised drawings have been provided, showing corrected layout, and that any obstructions have been removed or corrections to layout have been made.

3.03 INSTALLATION

A. Install athletic field equipment in accordance with manufacturer's instructions, and rules and regulations of specified athletic association indicated for this work.

B. Install athletic field equipment without sharp points, edges, or protrusions; entanglement hazards or pinch, crush, or shear points.

C. Install safety and warning signage, as follows, in accordance with indicated requirements.

3.04 CLEANING

A. Clean athletic field equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation; clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

B. Clean athletic field area of excess construction materials, debris, and waste.

C. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

3.05 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 260513
MEDIUM-VOLTAGE CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Medium voltage cable.

B. Cable accessories.

1.02 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems.

B. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes: Cable racks in manholes.

1.03 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. IEEE 48 - IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV; 2020.

C. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

D. NEMA WC 71 - Nonshielded Cables Rated 2001-5000 V for Use in the Distribution of Electric Energy; 2014 (Reaffirmed 2022).

E. NEMA WC 74 - 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy; 2022.

F. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for cable, terminations, and accessories.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Samples: Submit two samples of each size cable, 24 inches in length.
   1. Select each length to include complete set of manufacturer markings.
   2. Attach tag indicating cable size and application information.

E. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual sizes and locations of cables.

H. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

I. Maintenance Data: Include instructions for testing and cleaning cable and accessories.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MEDIUM-VOLTAGE CABLE

A. Manufacturers:
   1. General Cable Technologies Corporation: www.generalcable.com/#sle.
   2. Okonite: www.okonite.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Medium Voltage Cable: NEMA WC 70 rubber insulated cable.

2.02 CABLE ACCESSORIES

A. Manufacturers:
   1. 3M: www.3m.com/#sle.
   2. TE Connectivity; Raychem Products: www.te.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Potheads: IEEE 48, Class 1 termination. Pothead with porcelain insulators, cable connector and aerial lug, sealed cable entrance and support, and insulating compound.

C. Cable Terminations: IEEE 48, Class 2 porcelain insulator cable terminator in kit form.

D. Cast Epoxy Cable Terminations: IEEE 48, Class 1 cast epoxy cable termination in kit form with stress cone, shield ground connection, wet porcelain rain shield for outdoor units, epoxy resin molding material, and accessories and molds required for proper application.

E. Modular Cable Terminations: IEEE 48, Class 1, molded-rubber cable termination in kit form with stress cone, ground clamp, non-tracking rubber skirts, load break connector, rubber cap, and aerial lug.

F. Tape Terminations: IEEE 48; Class 1, tape termination kit with semi- conductive tape, stress control tape, splicing tape, vinyl plastic tape, stress cone, mechanical ground straps, and cable preparation kit.

G. Fireproofing Tape:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conduit, duct, trench, or manholes are ready to receive cable.
B. Verify that field measurements are as indicated.
C. Verify routing and termination locations of cable bank prior to rough-in.
D. Cable routing is shown in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 PREPARATION

A. Use swab to clean conduits before pulling cables.

3.03 INSTALLATION

A. Avoid abrasion and other damage to cables during installation.
B. Use suitable lubricants and pulling equipment.
C. Sustain cable pulling tensions and bending radii below recommended limits.
D. Ground cable shield at each termination and splice.
E. Install cables in manholes along wall providing longest route.
F. Arrange cable in manholes to avoid interference with duct entrances.
G. Fireproof cables in manholes using fireproofing tape in half-lapped wrapping. Extend fireproofing 1 inch into duct.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.
B. Inspect exposed cable sections for physical damage.
C. Inspect cable for proper connections as indicated.
D. Inspect shield grounding, cable supports, and terminations for proper installation.
E. Inspect and test in accordance with NETA ATS, except Section 4.
F. Perform inspections and tests listed in NETA ATS, Section 7.3.3. The cable time domain reflectometer (TDR) measurements on each conductor listed as optional are not required.

3.05 PROTECTION

A. Protect installed cables from entrance of moisture.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.
B. Nonmetallic-sheathed cable.
C. Underground feeder and branch-circuit cable.
D. Service entrance cable.
E. Armored cable.
F. Metal-clad cable.
G. Power and control tray cable.
H. Manufactured wiring systems.
I. Wiring connectors.
J. Electrical tape.
K. Heat shrink tubing.
L. Oxide inhibiting compound.
M. Wire pulling lubricant.
N. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.
B. Section 260505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
C. Section 260513 - Medium-Voltage Cables: Cables and terminations for systems 601 V through 35,000 V.
D. Section 260519.13 - Undercarpet Electrical Power Cables: Flat conductor cable and fittings for undercarpet power distribution.
E. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
F. Section 260536 - Cable Trays for Electrical Systems: Additional installation requirements for cables installed in cable tray systems.
G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
H. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.
I. Section 263100 - Photovoltaic Collectors: Additional wiring requirements for photovoltaic systems.
J. Section 284600 - Fire Detection and Alarm: Fire alarm system conductors and cables.
K. Section 312316 - Excavation.
L. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

M. Section 312323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).

F. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

G. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

H. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); 2008a (Validated 2019).

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

J. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

K. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.

L. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

M. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. UL 4 - Armored Cable; Current Edition, Including All Revisions.

P. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

Q. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

R. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

S. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

T. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

U. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

V. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

W. UL 719 - Nonmetallic-Sheathed Cables; Current Edition, Including All Revisions.

X. UL 854 - Service-Entrance Cables; Current Edition, Including All Revisions.

Y. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

Z. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

E. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual installed circuiting arrangements. Record actual routingfor underground circuits.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Manufactured Wiring Systems Cable Assemblies: One of each configuration, 6 feet length.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
   1. Exceptions:
      a. Use manufactured wiring systems for branch circuits where concealed under raised floors.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.
      b. Use power and control tray cable or metal-clad cable for installation in cable tray.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Armored cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet.
   2. In addition to other applicable restrictions, may not be used:
      a. Unless approved by Owner.
      b. Where not approved for use by the authority having jurisdiction.
      c. Where exposed to view.
      d. Where exposed to damage.
      e. For damp, wet, or corrosive locations.
      f. For isolated ground circuits.

F. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

H. Minimum Conductor Size:12 AWG.
1. Branch Circuits: 12 AWG.
a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

J. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.
b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.
c. Equipment Ground, All Systems: Green.
d. Isolated Ground, All Systems: Green with yellow stripe.
e. Travelers for 3-Way and 4-Way Switching: Pink.
f. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
a. Cerro Wire LLC: www.cerrowire.com.
b. Encore Wire Corporation: www.encorewire.com/#sle.
c. General Cable Technologies Corporation: www.generalcable.com/#sle.
d. Southwire Company: www.southwire.com/#sle.
e. Substitutions: See Section 016000 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.

b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Size 4 AWG and Larger: Type XHHW-2.
b. Installed Underground: Type XHHW-2.
c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 SERVICE ENTRANCE CABLE

A. Manufacturers:
1. Copper Service Entrance Cable:
a. Cerro Wire LLC: www.cerrowire.com/#sle.
b. Encore Wire Corporation: www.encorewire.com/#sle.
c. Southwire Company: www.southwire.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 600 V.

2.05 ARMORED CABLE

A. Manufacturers:
1. AFC Cable Systems Inc: www.afcweb.com/#sle.
2. Encore Wire Corporation: www.encorewire.com/#sle.
3. Southwire Company: www.southwire.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN.

F. Grounding: Combination of interlocking armor and integral bonding wire.
1. Provide additional full-size integral insulated equipment grounding conductor for redundant grounding, suitable for general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities.

G. Armor: Steel, interlocked tape.

2.06 POWER AND CONTROL TRAY CABLE

A. Manufacturers:
1. Encore Wire Corporation: www.encorewire.com/#sle.
2. General Cable Technologies Corporation

3. Okonite: www.okonite.com/#sle.
4. Southwire Company: www.southwire.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.

C. Where exposed run cable is indicated between cable tray and utilization equipment in qualifying industrial establishments as determined by authorities having jurisdiction, provide tray cable marked as Type TC-ER in accordance with NFPA 70.

D. Conductor Stranding: Stranded.

E. Insulation Voltage Rating: 600 V.

F. Insulation: Type XHHW or XHHW-2.

G. Grounding: Full-size integral equipment grounding conductor.

H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.07 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Ideal Industries, Inc: www.idealindustries.com/#sle.
c. NSI Industries LLC: www.nsiindustries.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
   2.
      a. Burndy LLC: www.burndy.com/#sle.
      b. Bundy, LLC
      c. Ilsco: www.ilsco.com/#sle.
      d. Thomas & Betts Corporation: www.tnb.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Thomas & Betts Corporation: www.tnb.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

2.08 WIRING ACCESSORIES

A. Electrical Tape:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
   2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
   3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
   4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
   5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
   6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
   7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Burndy LLC: www.burndy.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. Ilsco: www.ilsco.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. American Polywater Corporation: www.polywater.com/#sle.
      c. Ideal Industries, Inc: www.idealindustries.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.

8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
    a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
    b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install armored cable (Type AC) in accordance with NECA 120.

E. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

H. Terminate cables using suitable fittings.
1. Armored Cable (Type AC):
    a. Use listed fittings and anti-short, insulating bushings.
    b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.
B. Conductors for grounding and bonding.
C. Connectors for grounding and bonding.
D. Ground bars.
E. Ground rod electrodes.
F. Chemically-enhanced ground electrodes.
G. Ground plate electrodes.
H. Ground enhancement material.
I. Ground access wells.
J. Pre-fabricated signal reference grids.

1.02 RELATED REQUIREMENTS

A. Section 096500 - Resilient Flooring: Static control flooring.
B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   1. Includes oxide inhibiting compound.
C. Section 260536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.
D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 263100 - Photovoltaic Collectors: Additional grounding and bonding requirements for photovoltaic systems.
F. Section 265600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.
G. Section 337900 - Site Grounding.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.
D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

G. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2023.

H. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. For signal reference grids, coordinate the work with access flooring furnished in accordance with Section 096900.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   5. Ground Rod Electrode(s):
      a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
      b. Space electrodes not less than 10 feet from each other and any other ground electrode.

c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
d. Provide ground enhancement material around electrode where indicated.
e. Provide ground access well for each electrode.

6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
   c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

I. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
   a. Transformers (except autotransformers such as buck-boost transformers).
   b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
   c. Generators, when neutral is switched in the transfer switch.
2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.

5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

J. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
   c. Metal process piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.
10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
12. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.

K. Isolated Ground System:
1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

L. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
    c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
    d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
    1. Provide products listed, classified, and labeled as suitable for the purpose intended.
    2. Provide products listed and labeled as complying with UL 467 where applicable.
B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
    1. Use insulated copper conductors unless otherwise indicated.
        a. Exceptions:
            1) Use bare copper conductors where installed underground in direct contact with earth.
            2) Use bare copper conductors where directly encased in concrete (not in raceway).
    2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gage of specified conductors.
C. Connectors for Grounding and Bonding:
    1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
    2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
        a. Exceptions:
            1) Use mechanical connectors for connections to electrodes at ground access wells.
    3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
        a. Exceptions:
            1) Use exothermic welded connections for connections to metal building frame.
    4. Manufacturers - Mechanical and Compression Connectors:
        a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
        b. Burndy LLC: www.burndy.com/#sle.
        c. Harger Lightning & Grounding: www.harger.com/#sle.
        d. Thomas & Betts Corporation: www.tnb.com/#sle.
        e. Substitutions: See Section 016000 - Product Requirements.
    5. Manufacturers - Exothermic Welded Connections:
        a. Burndy LLC: www.burndy.com/#sle.
        b. Cadweld, a brand of Erico International Corporation: www.erico.com/#sle.
        c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
D. Ground Bars:
    1. Description: Copper rectangular ground bars with mounting brackets and insulators.
    2. Size: As indicated.
    3. Holes for Connections: As indicated or as required for connections to be made.
E. Ground Rod Electrodes:
    1. Comply with NEMA GR 1.

2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
5. Manufacturers:
   a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
   b. Erico International Corporation: www.erico.com/#sle.
   c. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
   d. Harger Lightning & Grounding: www.harger.com/#sle.
   e. Substitutions: See Section 016000 - Product Requirements.

F. Ground Enhancement Material:
1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.

G. Ground Access Wells:
1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.

E. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

F. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

D. Section 260536 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

E. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

F. Section .

G. Section 262513 - Low-Voltage Busways: Additional support and attachment requirements for busway.

H. Section 263100 - Photovoltaic Collectors: Photovoltaic module mounting systems.

I. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

J. Section 265133 - Luminaires and Drivers - Lutron: Additional support and attachment requirements for luminaires.

K. Section 265600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
   1. Fiberglass Channel (Strut) Framing Systems: Include requirements for strength derating according to ambient temperature.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Derating Calculations for Fiberglass Channel (Strut) Framing Systems: Indicate load ratings adjusted for applicable service conditions.

E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

F. Installer's Qualification Statement: Include evidence of compliance with specified requirements.

G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Installer Qualifications for Field-Welding: As specified in Section 055000.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Components for Vibration Isolation and/or Seismic Controls: Comply with Section .

C. Materials for Metal Fabricated Supports: Comply with Section 055000.

D. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Erico International Corporation: www.erico.com/#sle.
      c. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      d. Thomas & Betts Corporation: www.tnb.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.

E. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.

b. Erico International Corporation: www.erico.com/#sle.
c. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
d. Thomas & Betts Corporation: www.tnb.com/#sle.
e. Substitutions: See Section 016000 - Product Requirements.

F. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
3. Channel Material:
a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
6. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Thomas & Betts Corporation: www.tnb.com/#sle.
c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.
e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

G. Fiberglass Channel (Strut) Framing Systems: Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Channel Material: Use polyester resin or vinyl ester resin.
2. Minimum Channel Dimensions: 1-5/8 inch width by 1 inch height.
3. Flammability: Fire retardant with NFPA 101, Class A flame spread index (maximum of 25) when tested in accordance with ASTM E84; self-extinguishing in accordance with ASTM D635.
4. Manufacturers:
a. Enduro Composites: www.endurocomposites.com/#sle.
b. Substitutions: See Section 016000 - Product Requirements.
c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

H. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2 inch diameter.
b. Busway Supports: 1/2 inch diameter.
c. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
d. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
f. Outlet Boxes: 1/4 inch diameter.
g. Luminaires: 1/4 inch diameter.

I. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
4. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
   b. Erico International Corporation: www.erico.com/#sle.
   c. PHP Systems/Design: www.phpsd.com/#sle.
   d. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
   e. Substitutions: See Section 016000 - Product Requirements.

J. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
14. Manufacturers - Mechanical Anchors:
    a. Hilti, Inc: www.us.hilti.com/#sle.
    b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
    c. Powers Fasteners, Inc: www.powers.com/#sle.
    d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Provide required vibration isolation and/or seismic controls in accordance with Section .

I. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: Also comply with Section 260533.13.

K. Cable Tray Support and Attachment: Also comply with Section 260536.

L. Box Support and Attachment: Also comply with Section 260533.16.

M. Busway Support and Attachment: Also comply with Section 262513.

N. Interior Luminaire Support and Attachment: Also comply with Section 265100.

O. Exterior Luminaire Support and Attachment: Also comply with Section 265600.

P. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

Q. Secure fasteners according to manufacturer's recommended torque settings.

R. Remove temporary supports.

S. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Intermediate metal conduit (IMC).
D. PVC-coated galvanized steel rigid metal conduit (RMC).
E. Flexible metal conduit (FMC).
F. Liquidtight flexible metal conduit (LFMC).
G. Electrical metallic tubing (EMT).
H. Rigid polyvinyl chloride (PVC) conduit.
I. Electrical nonmetallic tubing (ENT).
J. Liquidtight flexible nonmetallic conduit (LFNC).
K. Reinforced thermosetting resin conduit (RTRC).
L. Conduit fittings.
M. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 078400 - Firestopping.
C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
D. Section 260526 - Grounding and Bonding for Electrical Systems.
    1. Includes additional requirements for fittings for grounding and bonding.
E. Section 260529 - Hangers and Supports for Electrical Systems.
F. Section 260533.16 - Boxes for Electrical Systems.
G. Section 260533.23 - Surface Raceways for Electrical Systems.
H. Section .
I. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
J. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
K. Section 271000 - Structured Cabling: Additional requirements for communications systems conduits.
L. Section 312316 - Excavation.
M. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.
N. Section 312323 - Fill: Bedding and backfilling.

O. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.
D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
L. NEMA BI 50058 - Electrical Nonmetallic Tubing (ENT); 2014 (Reaffirmed 2019).
M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
N. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
O. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
P. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
Q. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
S. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
T. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.

6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:
1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.

E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT). Do not use MC cable in walls or ceilings except for the final connection to lighting fixtures, and less than 6' lengths.

F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
1. Locations subject to physical damage include, but are not limited to:
a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

J. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Electrical Service Conduits: Also comply with Section 262100.

C. Communications Systems Conduits: Also comply with Section 271000.

D. Fittings for Grounding and Bonding: Also comply with Section 260526.

E. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.

G. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
   2. Underground, Interior: 3/4 inch (21 mm) trade size.
   3. Underground, Exterior: 1 inch (27 mm) trade size.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries www.wheatland.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
   4. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
   4. Material: Use aluminum.

5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Allied Tube & Conduit www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Thomas & Betts Corporation www.tnb.com/#sle.
   2. Robroy Industries www.robroy.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

D. Interior Coating: Urethane, minimum thickness of 2 mil.

E. PVC-Coated Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.07 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.09 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit www.alliedeg.com/#sle.
   2. Republic Conduit www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   4. Connectors and Couplings: Use compression (gland) type.
      a. Do not use indenter type connectors and couplings.

b. Do not use set-screw type connectors and couplings.

5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com/#sle.
   2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
   3. JM Eagle www.jmeagle.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

B. Supports: Per manufacturer's recommendations.

C. Fittings: Same type and manufacturer as conduit to be connected.

2.12 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

E. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

G. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

H. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle.
      b. Substitutions:

I. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for the casing and conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Bore Spacers: www.apsonline.com/#sle.
      b. Substitutions:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.

E. Install intermediate metal conduit (IMC) in accordance with NECA 101.

F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

H. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   9. Arrange conduit to provide no more than 150 feet between pull points.
   10. Route conduits above water and drain piping where possible.

11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in the same area together on a common rack.

I. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required vibration isolation and/or seismic controls in accordance with Section .
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
10. Use of spring steel conduit clips for support of conduits is not permitted.
11. Use of wire for support of conduits is not permitted.
    a. For securing conduits to studs in hollow stud walls.
    b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).
12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

K. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
   3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
   4. Conceal bends for conduit risers emerging above ground.
   5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
   6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
   7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
   9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
   10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

L. Underground Installation:
   1. Provide trenching and backfilling in accordance with Section 312316.13.
   2. Minimum Cover, Unless Otherwise Indicated or Required:
      a. Underground, Exterior: 24 inches.
      b. Under Slab on Grade: 12 inches to bottom of slab.
   3. Provide underground warning tape in accordance with Section 260553 along entire conduit length for service entrance where not concrete-encased.

M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
   1. Include proposed conduit arrangement with submittals.
   2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
   3. Install conduits within middle one third of slab thickness.
   4. Secure conduits to prevent floating or movement during pouring of concrete.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 033000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

O. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
   4. Where conduits are subject to earth movement by settlement or frost.

Q. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

R. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

S. Provide grounding and bonding in accordance with Section 260526.

T. Identify conduits in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
C. Boxes and enclosures for integrated power, data, and audio/video.
D. Boxes for hazardous (classified) locations.
E. Floor boxes.
F. Underground boxes/enclosures.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.
B. Section 078400 - Firestopping.
C. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
D. Section 260526 - Grounding and Bonding for Electrical Systems.
E. Section 260529 - Hangers and Supports for Electrical Systems.
F. Section 260533.13 - Conduit for Electrical Systems:
    1. Conduit bodies and other fittings.
    2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
G. Section 260533.23 - Surface Raceways for Electrical Systems:
    1. Accessory boxes designed specifically for surface raceway systems.
    2. Lay-in wireways and wiring troughs with removable covers.
H. Section 260539 - Underfloor Raceways for Electrical Systems: Junction boxes for underfloor duct systems.
I. Section .
J. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
K. Section 262726 - Wiring Devices:
    1. Wall plates.
    2. Floor box service fittings.
    3. Poke-through assemblies.
    4. Access floor boxes.
    5. Additional requirements for locating boxes for wiring devices.
L. Section 262813 - Fuses: Spare fuse cabinets.
M. Section 271000 - Structured Cabling: Additional requirements for communications systems outlet boxes.
N. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes: Concrete manholes for electrical systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).

F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
   1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Samples:

1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
6. Use suitable concrete type boxes where flush-mounted in concrete.
7. Use suitable masonry type boxes where flush-mounted in masonry walls.
8. Use raised covers suitable for the type of wall construction and device configuration where required.

9. Use shallow boxes where required by the type of wall construction.
10. Do not use "through-wall" boxes designed for access from both sides of wall.
11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
16. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: Comply with Section 271000.
17. Wall Plates: Comply with Section 262726.
18. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
    d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    e. Thomas & Betts Corporation: www.tnb.com/#sle.
    f. Substitutions: See Section 016000 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
    c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
    c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.

1. Manufacturers:
   a. Hubbell Incorporated: www.hubbell.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
   1. Manufacturers:
      a. Appleton, a brand of Emerson Electric Co: www.emerson.com/#sle.
      b. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      c. Hubbell Incorporated; Killark Products: www.hubbell-killark.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

F. Floor Boxes:
   1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
   2. Use cast iron floor boxes within slab on grade.
   3. Use sheet-steel or cast iron floor boxes within slab above grade.
   4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
   5. Manufacturer: Same as manufacturer of floor box service fittings.

G. Underground Boxes/Enclosures:
   1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
   2. Size: As indicated on drawings.
   3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
   4. Provide logo on cover to indicate type of service.
   5. Applications:
      a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
      b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
      c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
   6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
      a. Manufacturers:
         1) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com/#sle.
         2) MacLean Highline: www.macleanhighline.com/#sle.
         3) Oldcastle Precast, Inc: www.oldcastleprecast.com/#sle.
         4) Substitutions: See Section 016000 - Product Requirements.
      b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
      c. Product(s):
         1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
            (a) 11 by 18 by 12 inches nominal; Model PHA111812 (stackable).
         2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
            (a) 11 by 18 by 12 inches nominal; Model CHA111812.
         3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.

(a) 30 by 48 by 18 inches nominal; Model CVA304818.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
      b. Communications Systems Outlets: Comply with Section 271000.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
   9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
      b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
   10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.

11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required seismic controls in accordance with Section .
3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
5. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.

M. Install boxes as required to preserve insulation integrity.

N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

P. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Provide cast-in-place concrete collar constructed in accordance with Section 033000, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

S. Close unused box openings.

T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

U. Provide grounding and bonding in accordance with Section 260526.

V. Identify boxes in accordance with Section 260553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 260533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface raceway systems.
B. Wireways.
C. Wall duct.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.
B. Section 260529 - Hangers and Supports for Electrical Systems.
   1. Includes metal channel (strut) used as raceway.
C. Section 260533.13 - Conduit for Electrical Systems.
D. Section 260533.16 - Boxes for Electrical Systems.
E. Section 260539 - Underfloor Raceways for Electrical Systems: Trench duct.
F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
G. Section 262723 - Indoor Service Poles.
H. Section 262726 - Wiring Devices: Receptacles.
I. Section 271000 - Structured Cabling: Voice and data jacks.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
D. NEMA BI 50061 - Installation Guidelines for Surface and Nonmetallic Raceway; 2021 (Reapproved 2025).
E. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.
F. UL 5A - Nonmetallic Surface Raceways and Fittings; Current Edition, Including All Revisions.
G. UL 111 - Outline of Investigation for Multioutlet Assemblies; Current Edition, Including All Revisions.
H. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate rough-in locations of outlet boxes provided under Section 260533.16 and conduit provided under Section 260533.13 as required for installation of raceways provided under this section.
3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install raceways until final surface finishes and painting are complete.
2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

C. Shop Drawings:
1. Pre-wired Surface Raceway Systems: Provide plan and elevation views including dimensioned locations of wiring devices and circuiting arrangements.
2. Wireways: Provide dimensioned plan and elevation views including adjacent equipment with all required clearances indicated.

D. Samples: Three of each type and color of surface raceway system specified, 6 inches in length.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. MonoSystems, Inc: www.monosystems.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Surface Metal Raceways: Listed and labeled as complying with UL 5.

C. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.

D. Multioutlet Assemblies: Listed and labeled as complying with UL 111.

E. Metal Channel (Strut) Used as Raceway: Comply with Section 260529.

F. Surface Raceway System:
   1. Raceway Type: Single channel, painted steel.
   2. Length: As indicated on the drawings.
   3. Color: To be selected by Architect.
   4. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.
   5. Integrated Device Provisions:
      a. Receptacles:
         1) Comply with Section 262726, except for finishes.
         2) Configuration: As indicated on the drawings.
         3) Color: Match raceway.
         4) Spacing: As indicated on the drawings.
      b. Communications Outlets:
         1) Voice and Data Jacks: As specified in Section 271000.
         2) Voice and Data Jacks: Include provisions for jacks furnished by others.
         3) Configuration: As indicated on the drawings.
         4) Spacing: As indicated on the drawings.
   6. Products:
      a. Hubbell Incorporated: www.hubbell.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

2.03 WIREWAYS

A. Manufacturers:
   1. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com/#sle.
   2. Enduro Composites: www.endurocomposites.com/#sle.
   3. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
   4. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.

C. Wireway Type, Unless Otherwise Indicated:
   1. Indoor Clean, Dry Locations: NEMA EN 10250, Type 1, painted steel with screw-cover.
   2. Outdoor Locations: NEMA EN 10250, Type 3R, painted steel with screw-cover; include provision for padlocking.

D. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.

E. Minimum Wireway Size: 4 by 4 inches unless otherwise indicated.

F. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.04 WALL DUCT

A. Manufacturers:
   1. Dennis Filges Company, Inc: www.filgesco.com/#sle.
   2. Hubbell Incorporated: www.hubbell.com/#sle.
   3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
   4. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.
   6. Source Limitations: Where the wall duct system includes connections to trench duct as specified in Section 260539, furnish wall duct and associated components produced by the same manufacturer as the trench duct to be installed.

B. Description: Metal raceways specifically designed for enclosure of wiring to X-ray machines and similar medical equipment; listed and labeled as complying with UL 870.

C. Material: Steel, unless otherwise indicated.

D. Mounting Provisions: Suitable for surface- or flush-mounting as indicated.

E. Size: As indicated on the drawings.

2.05 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory test each production unit for pre-wired surface raceway systems to verify proper wiring.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install raceways plumb and level.

D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

E. Secure and support raceways in accordance with Section 260529 at intervals complying with NFPA 70 and manufacturer's requirements.

F. Close unused raceway openings.

G. Provide grounding and bonding in accordance with Section 260526.

H. Identify raceways in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect raceways for damage and defects.

C. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.

D. Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 260536
CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal cable tray systems:
   1. Metal ladder cable tray.
   2. Metal ventilated trough cable tray.
   3. Metal solid-bottom cable tray.
   4. Metal single rail/center spine cable tray.
   5. Metal channel cable tray.
   6. Metal wire mesh/basket cable tray.

B. Fiberglass cable tray systems:
   1. Fiberglass ladder cable tray.
   2. Fiberglass solid-bottom cable tray.
   3. Fiberglass channel cable tray.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260529 - Hangers and Supports for Electrical Systems.

E. Section .

F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 271000 - Structured Cabling.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

D. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

E. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling; 2006.

I. NEMA FG 1 - Fiberglass Cable Tray Systems; 1993 (Revised 1994).

J. NEMA BI 50015 - Metal Cable Tray Systems; 2024.

K. NEMA VE 2 - Cable Tray Installation Guidelines; 2018.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 568 - Nonmetallic Cable Tray Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within cable tray required clearances.
   2. Coordinate arrangement of cable tray with the dimensions and clearance requirements of the actual products to be installed.
   3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   4. Notify of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.

C. Sequencing:
   1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.
   1. Fiberglass Cable Tray Systems: Include requirements for strength derating according to ambient temperature.

C. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.

D. Derating Calculations for Fiberglass Cable Tray Systems: Indicate span/load ratings adjusted for applicable service conditions.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA VE 2, except do not store cable tray outdoors without cover as permitted in NEMA VE 2.

B. Handle products carefully to avoid damage to finish.

PART 2 PRODUCTS

2.01 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

A. Provide new cable tray system consisting of all required components, fittings, supports, accessories, etc. as necessary for a complete system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.

D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under the service conditions at the installed location.

E. Unless otherwise indicated, specified span/load ratings are according to NEMA BI 50015 (metal cable tray systems) or NEMA FG 1 (fiberglass cable tray systems) with safety factor of 1.5 and working load only (no additional concentrated static load).

F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values according to NEMA BI 50015 (metal cable tray systems) or NEMA FG 1 (fiberglass cable tray systems) with applicable allowable tolerances.

2.02 METAL CABLE TRAY SYSTEMS

A. Manufacturers:
   1. Metal Cable Tray System - Basis of Design: _____.
   2. Metal Cable Tray System - Other Acceptable Manufacturers:
      a. Cablofil, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
      b. Chalfant Manufacturing Company; _____: www.chalfant-obo.com/#sle.
      c. Cope, a brand of Atkore International Inc; _____: www.copecabletray.com/#sle.
      d. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.
   4. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
   5. Source Limitations: Furnish cable tray system and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Comply with NEMA BI 50015.

C. Finishes:
   1. Zinc Electroplated Steel: Comply with ASTM B633.

2. Mill-Galvanized Before Fabrication (Pre-Galvanized) Steel: Comply with ASTM A653/A653M, G90 coating.
3. Hot-Dip Galvanized After Fabrication (H.D.G.A.F.) Steel: Comply with ASTM A123/A123M.
4. Stainless Steel: Type 304 or Type 316.

D. Metal Ladder Cable Tray:
1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
2. Side Rail Construction: I-beam, C-channel flange out, or C-channel flange in.
3. Load/Fill Depth: As indicated on drawings.
4. Span/Load Rating: As indicated on drawings.
5. Rung Spacing: 9 inches on center for straight lengths.
6. Inside Width: As indicated on drawings.
7. Inside Radius of Fittings: 12 inches.
8. Covers: Solid flat flanged.
9. Products:
   a. Chalfant Manufacturing Ladder Tray; _____: www.chalfant-obo.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

E. Metal Ventilated Trough Cable Tray:
1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
2. Bottom Type: Vented corrugated.
3. Load/Fill Depth: As indicated on drawings.
4. Span/Load Rating: As indicated on drawings.
5. Inside Width: As indicated on drawings.
6. Inside Radius of Fittings: 12 inches.
7. Covers: Solid flat flanged.
8. Products:
   a. Chalfant Manufacturing RKS-Magic; _____: www.chalfant-obo.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

F. Metal Solid-Bottom Cable Tray:
1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
2. Bottom Type: Solid corrugated or flat.
3. Load/Fill Depth: As indicated on drawings.
4. Span/Load Rating: As indicated on drawings.
5. Inside Width: As indicated on drawings.
6. Inside Radius of Fittings: 12 inches.
7. Covers: Solid flat flanged.

G. Metal Single Rail/Center Spine Cable Tray:
1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
2. Configuration: Center rail or wall mount as indicated.
3. Number of Tiers: Single tier.
4. Load/Fill Depth: As indicated on drawings.
5. Span/Load Rating: As indicated on drawings.
6. Rung Spacing: 9 inches on center for straight lengths.
7. Inside Width: As indicated on drawings.
8. Inside Radius of Fittings: 12 inches.

H. Metal Channel Cable Tray:
1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
2. Bottom Type: Solid bottom.
3. Tray Depth: 1-3/4 inches.

4. Span/Load Rating: As indicated on drawings.
5. Tray Width: 4 inches.
6. Inside Radius of Fittings: 12 inches.
7. Covers: Solid flat flanged.

I. Metal Wire Mesh/Basket Cable Tray:
1. Tray Depth: As indicated on drawings.
2. Span/Load Rating: As indicated on drawings.
3. Mesh Spacing: 2 by 4 inches.
4. Tray Width: As indicated on drawings.

2.03 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Metal Cable Tray: Perform factory design tests in accordance with NEMA BI 50015, including electrical continuity and load testing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage cable tray system has been completed.

B. Verify that field measurements are as indicated.

C. Verify that the dimensions and span/load ratings of cable tray system components are consistent with the indicated requirements.

D. Verify that mounting surfaces are ready to receive cable tray and associated supports.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Modifications to Existing Cable Tray Systems: Remove inactive or abandoned cables from existing cable tray system.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install cable tray in accordance with NECA 1 (general workmanship), and NEMA VE 2.

C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.

D. Arrange cable tray to provide required clearances and maintain cable access.
1. Minimum Clearance Above and Adjacent to Cable Tray: 12 inches.
2. Cable Tray for Telecommunications Cables: Maintain recommended separation from sources of EMI greater than 5 kVA in accordance with NECA/BICSI 568.

E. Install cable tray plumb and level, with sections aligned and with horizontal runs at the proper elevation.

F. Metal Wire Mesh/Basket Cable Tray: Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.
1. Inside Radius of Fittings: 12 inches.

G. Hot-Dip Galvanized After Fabrication (H.D.G.A.F.) Steel Cable Tray: After cutting, drilling, or deburring, use approved zinc-rich paint to repair finish in accordance with ASTM A780/A780M.

H. Cable Tray Movement Provisions:

1. Provide suitable expansion fittings where cable tray is subject to movement, including but not limited to:
   a. Where cable tray crosses structural joints intended for expansion.
   b. Long straight cable tray runs in accordance with NEMA VE 2.
2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA VE 2.
3. Set gaps for expansion fittings in accordance with NEMA VE 2.

I. Cable Provisions:
1. Use suitable fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
2. Use suitable drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
3. Use suitable cable support fittings for long vertical cable tray runs with heavy cables.

J. Provide end closures at unconnected ends of cable tray runs.

K. Cable Tray Support:
1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA VE 2 and manufacturer's requirements, but not exceeding specified span. Provide required support and attachment in accordance with Section , where not furnished by cable tray manufacturer.
   a. Cable Trays Supporting Welding Cables: Do not exceed 6 inches between supports in accordance with NFPA 70.
2. Provide required vibration isolation and/or seismic controls in accordance with Section .
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

L. Grounding and Bonding Requirements, in Addition to Requirements of Section 260526:
1. Comply with grounding and bonding requirements of NEMA VE 2.
2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified connectors to provide electrical continuity.
3. Provide suitable equipment grounding conductor in each cable tray, except where cable tray contains only multiconductor cables with integral equipment grounding conductors. Do not use metal cable tray system as sole equipment grounding conductor.
   a. Equipment Grounding Conductor for Steel Cable Tray: Use bare or insulated copper conductor.
   b. Equipment Grounding Conductor for Aluminum Cable Tray: Use insulated copper conductor only; do not use bare copper conductor.
   c. Minimum Equipment Grounding Conductor Size: 6 AWG copper.
   d. Bond equipment grounding conductor to each cable tray section using suitable listed ground clamps. Separate bonding jumpers are not required where properly bonded equipment grounding conductor provides equivalent continuity.

M. Conduit Termination:
1. Use listed cable tray conduit clamps (evaluated for bonding connection) to terminate conduits at cable tray.
2. Provide insulating bushing at conduit termination to protect cables.
3. Provide independent support for conduit.

N. Cable Installation:
1. Comply with cable installation requirements of NEMA VE 2.
2. Use appropriate cable pulling tools, applied to prevent excessive force on cable tray system and maintain minimum cable bending radius.
3. Use cable clamps or cable ties to fasten conductors/cables to vertical and horizontal runs of cable tray.
   a. Distance Between Fastening Points for Vertical Runs: 18 inches.

b. Distance Between Fastening Points for Horizontal Runs: As required to maintain spacing and confine conductor/cable within the cable fill area.

O. Penetrations: Install firestopping to preserve fire resistance rating of building elements, using materials and methods specified in Section 078400.

P. Identification Requirements, in Addition to Those Specified in Section 260553.
1. Use warning labels to identify cable tray containing service-entrance conductors with the word message "SERVICE-ENTRANCE CONDUCTORS" at maximum intervals of 10 feet.
2. Use warning labels to identify electrical hazards for cable tray containing conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP AWAY" at maximum intervals of 10 feet.
3. Use warning labels to identify cable tray with the word message "WARNING! Do Not Use As A Walkway, Ladder, Or Support For Personnel. Use Only As A Mechanical Support For Cables, Tubing and Raceways." at maximum intervals of 20 feet.
4. Use identification nameplates to identify cable tray containing welding cables with the word message "CABLE TRAY FOR WELDING CABLES ONLY" at maximum intervals of 20 feet.

Q. Install cable tray covers where indicated and as follows:
1. For first 6 feet of cable tray extending vertically from a floor penetration.
2. Where cable tray passes under open walkways.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect cable tray system for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective cable tray system components.

3.05 ADJUSTING

A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.06 CLEANING

A. Remove dirt and debris from cable tray.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 PROTECTION

A. Protect cable tray system from subsequent construction operations.

END OF SECTION

SECTION 260548
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Vibration-isolated equipment support bases.

D. Vibration isolators.

E. External seismic snubber assemblies.

F. Seismic restraint systems.

1.02 RELATED REQUIREMENTS

A. Section 014533 - Code-Required Special Inspections and Procedures.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

D. Section 260529 - Hangers and Supports for Electrical Systems.

1.03 DEFINITIONS

A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g. conduit, cable tray).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.

F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.

G. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2020).

I. MFMA-4 - Metal Framing Standards Publication; 2004.

J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Seismic Controls:
      a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
      b. Coordinate the work with other trades to accommodate relative positioning of essential and non-essential components in consideration of seismic interaction.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification method for spring element load capacities.
   2. Seismic Controls: Include seismic load capacities.

D. Shop Drawings - Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
   2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Shop Drawings - Seismic Controls:
   1. Include dimensioned plan views and sections indicating proposed electrical component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
   2. Identify mounting conditions required for equipment seismic qualification.
   3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
   4. Indicate proposed arrangement of distributed system trapeze support groupings.

5. Indicate proposed locations for distributed system flexible fittings and/or connections.
6. Indicate locations of seismic separations where applicable.
7. Include point load drawings indicating design loads transmitted to structure at each attachment location.

F. Seismic Design Data:
1. Compile information on project-specific characteristics of actual installed electrical components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
a. Component operating weight and center of gravity.
b. Component elevation in the building in relation to the roof elevation (z/h).
c. Component importance factor (Ip).
d. For distributed systems, component materials and connection methods.
e. Component amplification factor (ap) and component response modification factor (Rp), determined in accordance with ASCE 7 tables.
f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

G. Certification for seismically qualified equipment; identify basis for certification.

H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Evidence of qualifications for seismic controls designer.

K. Evidence of qualifications for manufacturer.

L. Manufacturer’s detailed field testing and inspection procedures.

M. Field quality control test reports.

1.07 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
1. Designer may be employed by the manufacturer of the seismic restraint products.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
   4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
   5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2 inch operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation:
   1. Transformers:
      a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
      b. Floor-Mounted Transformers, Non-Seismic Applications: Use resilent material isolator pads, resilient material isolator mounts, or open (unhoused) spring isolators.
      c. Floor-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts or seismic type restrained spring isolators.
      d. Suspended Transformers, Non-Seismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
      e. Suspended Transformers, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
      f. Wall-Mounted Transformers, Non-Seismic Applications: Use resilient material isolator mounts.
      g. Wall-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts.
      h. Minimum Static Deflection:
         1) Transformers Mounted on Grade-Level Slabs: 0.25 inch deflection unless otherwise indicated.
         2) Transformers Mounted at Above-Grade Levels: 0.5 inch deflection unless otherwise indicated.
   2. Engine Generators:
      a. Specified vibration isolators are in addition to any factory-installed internal vibration isolators between generator set and integral base unless otherwise indicated; obtain generator set manufacturer approval of applied vibration isolation.
      b. Non-Seismic Applications, Isolators Not Located Below Sub-Base Fuel Tank: Use housed spring isolators or restrained spring isolators.
      c. Non-Seismic Applications, Isolators Located Below Sub-Base Fuel Tank: Use restrained spring isolators.
      d. Seismic Applications: Use seismic type restrained spring isolators.
      e. Provide vibration-isolated concrete inertia bases where indicated.

f. Minimum Static Deflection:
   1) Generators Mounted on Grade-Level Slabs: 1 inch deflection unless otherwise indicated.
   2) Generators Mounted at Above-Grade Levels: 2 inch deflection unless otherwise indicated.

E. Conduit Isolation:
1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
   a. Minimum Length: 3 feet unless otherwise indicated.
2. Vibration Isolators:
   a. Provide vibration isolators for conduit supports:
      1) Located within 50 feet of connected vibration-isolated equipment where flexible connection to equipment is not possible.
      2) For conduits over 2 inch trade size located below or within 50 feet of noise-sensitive areas indicated.
   b. Minimum Static Deflection:
      1) First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
      2) Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
   c. Suspended Conduits, Non-Seismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   d. Suspended Conduits, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
   e. Use modular seal or approved resilient material where vibration-isolated conduits penetrate building elements (e.g. walls, floors) arranged to prevent vibration transmission to structure.

2.02 SEISMIC CONTROL REQUIREMENTS

A. Design and provide electrical component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor electrical components.

B. Seismic Design Criteria: As indicated on drawings.

C. Seismic Qualification of Equipment:
1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

D. Premanufactured Modular Electrical Equipment: Where not otherwise seismically qualified, premanufactured modules 6 feet high and taller furnished under other sections to be designed in accordance with seismic provisions for nonbuilding structures.

E. Seismic Restraints:

1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Seismic Restraint Exemptions:
    a. Exemptions for Seismic Design Category C:
        1) Electrical components where either of the following apply:
            (a) The component importance factor (Ip) is 1.0 and the component is positively attached to the structure.
            (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
    b. Exemptions for Seismic Design Category D, E, and F:
        1) Discrete electrical components that are positively attached to the structure where either of the following apply:
            (a) The component weighs 400 pounds or less, has a center of mass located 4 feet or less above the adjacent floor level, flexible connections are provided between the component and associated ductwork, piping, and conduit, and the component importance factor (Ip) is 1.0.
            (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
    c. Conduit, Cable Tray, and Raceway Exemptions, All Seismic Design Categories:
        1) Raceways with component importance factor (Ip) of 1.0 where flexible connections are provided between cable tray or raceway and associated components, where cable tray or raceway is positively attached to the structure, and where one of the following apply:
            (a) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
            (b) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 200 pounds or less.
            (c) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
            (d) Hanger supported conduits, cable trays, or raceways with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds or less.
        2) Conduits less than 2-1/2 inch trade size.
    d. Lighting Exemptions, All Seismic Design Categories:
        1) Suspended luminaires where attachments are designed to accommodate 1.4 times the operating weight acting in both the vertical and horizontal directions and connections to structure allow for 360 degree range of motion in the horizontal plane; arrange to prevent impact between luminaires and the structure or other nonstructural components.
        2) Lay-in luminaires weighing less than 56 pounds secured to ceiling grid and provided with safety wires in accordance with ASTM E580/E580M.
3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
    a. ASHRAE (HVACA).

b. FEMA 413.
c. FEMA E-74.
d. SMACNA (SRM).

4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third party registered professional engineer acceptable to authorities having jurisdiction.
5. Seismic Type Vibration Isolators:
   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
6. External Seismic Snubber Assemblies:
   a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
   b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
7. Seismic Restraint Systems:
   a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
   b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
   c. Use only one restraint system type for a given electrical component or distributed system (e.g. conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.
   d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
   e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.
   f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.
   g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
   h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
   i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
   j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

F. Seismic Attachments:
1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.

4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
    a. Increase size of pad as required to comply with anchor requirements.
    b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:
1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
3. Comply with minimum clearance requirements between electrical equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.

H. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:
    a. Relative displacements at connections between components, including distributed systems (e.g. conduit, cable tray); do not exceed load limits for equipment utility connections.
    b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
    c. Design displacements at seismic separations.
    d. Anticipated drifts between floors.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
1. Vibration-Isolated Equipment Support Bases:
    a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
    b. Mason Industries: www.mason-ind.com/#sle.
    c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
2. Substitutions: See Section 016000 - Product Requirements.
3. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration-Isolated Structural Steel Bases:
1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

C. Vibration-Isolated Concrete Inertia Bases:
1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Minimum Base Depth: 6 inches.
3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 033000.

2.04 VIBRATION ISOLATORS

A. Manufacturers:
   1. Vibration Isolators:
      a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      b. Mason Industries: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.
   3. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
   2. Spring Elements for Spring Isolators:
      a. Color code or otherwise identify springs to indicate load capacity.
      b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
      c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
      d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
      e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
      f. Selected to function without undue stress or overloading.
   3. Seismic Snubbing Elements for Seismic Isolators:
      a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
      b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C. Vibration Isolators for Non-Seismic Applications:
   1. Resilient Material Isolator Pads:
      a. Description: Single or multiple layer pads utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material.
      b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
      c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
   2. Resilient Material Isolator Mounts, Non-Seismic:
      a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material; fail-safe type.
   3. Open (Unhoused) Spring Isolators:
      a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
      b. Bottom Load Plate: Non-skid molded elastomeric isolator material or steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.
      c. Furnished with integral leveling device for positioning and securing supported equipment.
   4. Housed Spring Isolators:
      a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.

b. Furnished with integral elastomeric snubbing elements, non-adjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
c. Bottom Load Plate: Steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.
d. Furnished with integral leveling device for positioning and securing supported equipment.

5. Restrained Spring Isolators, Non-Seismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
   b. Bottom Load Plate: Steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Non-Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
7. Spring Isolator Hangers, Non-Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Non-Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g. neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.

D. Vibration Isolators for Seismic Applications:
1. Resilient Material Isolator Mounts, Seismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g. neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g. neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
   b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g. neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.

4. Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g. neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.

2.05 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:
   1. External Seismic Snubber Assemblies:
      a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      b. Mason Industries: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.
   3. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

C. Seismic Snubbing Elements:
   1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
   2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.06 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:
   1. Seismic Restraint Systems:
      a. Eaton Corporation: www.eaton.com/#sle.
      b. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      c. Mason Industries: www.mason-ind.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.
   3. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C. Cable Restraints:
   1. Comply with ASCE 19.
   2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
   3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
   4. Use protective thimbles for cable loops where potential for cable damage exists.

D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 014533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
   1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Secure fasteners according to manufacturer's recommended torque settings.

E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Vibration Isolation Systems:

1. Vibration-Isolated Equipment Support Bases:
   a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
   a. Position equipment at operating height; provide temporary blocking as required.
   b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
   c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
   a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
   b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Clean debris from beneath vibration-isolated equipment that could cause short circuiting of isolation.
5. Use elastomeric grommets for attachments where required to prevent short circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

G. Seismic Controls:
1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:
   a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
   b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
   c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
   a. Size in accordance with seismic design to meet anchor requirements.
   b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
   a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
   b. Install restraints within permissible angles in accordance with seismic design.
   c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
   d. Install cable restraints for vibration-isolated components slightly slack to prevent short circuiting of isolation.
   e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Provide services of a manufacturer's authorized representative for vibration isolation systems and seismic controls to observe installation and assist in inspection and testing. Include manufacturer's detailed testing and inspection procedures and field reports with submittals.

D. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify required clearance beneath vibration-isolated equipment support bases.
   3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

E. Seismic Controls:
   1. Verify snubbing element air gaps.

F. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.05 ATTACHMENTS

A. Statement of special inspections.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Wire and cable markers.
D. Voltage markers.
E. Underground warning tape.
F. Floor marking tape.
G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting.
B. Section 099123 - Interior Painting.
C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
D. Section 260536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
E. Section 260573 - Power System Studies: Arc flash hazard warning labels.
F. Section 262300 - Low-Voltage Switchgear: Factory-installed mimic bus.
G. Section 262726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.
H. Section 263100 - Photovoltaic Collectors: Additional identification requirements for photovoltaic systems.
I. Section 271000 - Structured Cabling: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.
B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.
E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Samples:
   1. Identification Nameplates: One of each type and color specified.
   2. Warning Signs and Labels: One of each type and legend specified.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Switchgear:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use identification nameplate to identify main and tie devices.
         5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
         6) See Section 262300 for factory-installed mimic bus.
      b. Switchboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Use identification nameplate to identify main overcurrent protective device.
5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Motor Control Centers:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Use identification nameplate to identify main overcurrent protective device.
5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

d. Panelboards:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

e. Transformers:
1) Identify kVA rating.
2) Identify voltage and phase for primary and secondary.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Identify load(s) served. Include location when not within sight of equipment.

f. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

g. Busway:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Provide identification at maximum intervals of 40 feet.
5) Use identification nameplate to identify load(s) served for each plug-in unit. Include location when not within sight of equipment.

h. Time Switches:
1) Identify load(s) served and associated circuits controlled. Include location.

i. Enclosed Contactors:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
4) Identify coil voltage.
5) Identify load(s) and associated circuits controlled. Include location.

j. Centralized Emergency Lighting Inverters:
   1) Identify input and output voltage and phase.
   2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
   3) Identify load(s) served. Include location.
k. Transfer Switches:
   1) Identify voltage and phase.
   2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
   3) Identify load(s) served. Include location when not within sight of equipment.
   4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
l. Electricity Meters:
   1) Identify load(s) metered.

2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
   b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
3. Emergency System Equipment:
   a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
   b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
   c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
7. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
8. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
9. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
10. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
11. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
    a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 099123 and 099113.
12. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
    a. Service equipment.

b. Elevator control panels.
c. Industrial machinery.

13. Arc Flash Hazard Warning Labels: Comply with Section 260573.
14. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
15. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
16. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
17. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Identification for Communications Conductors and Cables: Comply with Section 271000.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
   a. At each source and load connection.
   b. Within boxes when more than one circuit is present.
   c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
   d. In cable tray, at maximum intervals of 20 feet.
5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
6. Use underground warning tape to identify direct buried cables.

D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
   a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      1) Color Code:
         (a) Emergency Power System: Red.
      2) Field-Painting: Comply with Section 099123 and 099113.
      3) Vinyl Color Coding Electrical Tape: Comply with Section 260519.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.

6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

E. Identification for Cable Tray: Comply with Section 260536.

F. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
   a. Color-Coded Boxes: Field-painted in accordance with Section 099123 and 099113 per the same color code used for raceways.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
   a. For exposed boxes in public areas, use only identification labels.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

G. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 271000.
2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
3. Factory Pre-Marked Wallplates: Comply with Section 262726.
4. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
5. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
   a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
6. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

H. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

I. Identification for Photovoltaic Systems: Comply with Section 263100

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
   a. Brimar Industries, Inc: www.brimar.com/#sle.
   b. Kolbi Pipe Marker Co{CH#275749}: www.kolbipipemarkers.com/#sle.
   c. Seton Identification Products: www.seton.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.
2. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
   a. Brady Corporation: www.bradyid.com/#sle.
   b. Brother International Corporation: www.brother-usa.com/#sle.
   c. Panduit Corp: www.panduit.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Emergency Power System: Identify with text "EMERGENCY".
      2) Fire Alarm System: Identify with text "FIRE ALARM".
   b. Equipment designation or other approved description.
   c. Other information as indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   c. Other Information: 1/4 inch.
   d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System: White text on red background.
   c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.
   a. Exceptions:
      1) Provide white text on red background for general information or operational instructions for emergency systems.
      2) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.

2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. HellermannTyton: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3.
4. Seton Identification Products: www.seton.com/#sle.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
   1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
   2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
   3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
   4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:
   1. Markers for Voltage Identification: Highest voltage present.
   2. Markers for System Identification:
      a. Emergency Power System: Text "EMERGENCY".

F. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com/#sle.
   2. Brimar Industries, Inc: www.brimar.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
   1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

E. Legend: Type of service, continuously repeated over full length of tape.

F. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 FLOOR MARKING TAPE

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com/#sle.
   2. Brimar Industries, Inc: www.brimar.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

A. Manufacturers:
   1. Brimar Industries, Inc: www.brimar.com/#sle.
   2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 260573
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 261116 - Secondary Unit Substations.

C. Section 261300 - Medium-Voltage Switchgear.

D. Section 261321 - Air Interrupter Switches.

E. Section 261839 - Medium-Voltage Motor Controllers.

F. Section 262100 - Low-Voltage Electrical Service Entrance.
   1. Includes Utility Company contact information.

G. Section 262300 - Low-Voltage Switchgear.

H. Section 262413 - Switchboards.

I. Section 262416 - Panelboards.

J. Section 262419 - Motor-Control Centers.

K. Section 262513 - Low-Voltage Busways.

L. Section 262813 - Fuses.

M. Section 262816.13 - Enclosed Circuit Breakers.

N. Section 262816.16 - Enclosed Switches.

O. Section 262913 - Enclosed Controllers.

P. Section 263323 - Central Battery Equipment.

Q. Section 263533.16 - Low-Voltage Power Factor Correction Equipment.

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 00001 - Motors and Generators; 2024.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
   2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.

C. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
   3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

D. Scheduling:
   1. Arrange access to existing facility for data collection with Owner.
   2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Study preparer's qualifications.

C. Field testing agency's qualifications.

D. Study reports, stamped or sealed and signed by study preparer.

E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
   1. Include characteristic time-current trip curves for protective devices.
   2. Include impedance data for busway.
   3. Include impedance data for engine generators.
   4. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

5. Include documentation of listed series ratings upon request.
6. Identify modifications made in accordance with studies that:
   a. Can be made at no additional cost to Owner.
   b. As submitted will involve a change to the contract sum.

F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

G. Site-specific arc flash hazard warning labels.

H. Field quality control reports.

I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

J. Project Record Documents: Revise studies as required to reflect as-built conditions.
   1. Include hard copies with operation and maintenance data submittals.
   2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of new electrical distribution system as indicated on drawings.
   2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
      a. Known Operating Modes:
         1) Utility as source.

B. General Study Requirements:
   1. Comply with NFPA 70.
   2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
         1) Obtain up-to-date information from Utility Company.
         2) Utility Company: See Section 262100 for Utility Company contact information.
      b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
      c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
      d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
      e. Protective Devices:
         1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).

2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.

g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

2. Existing Installations:

a. Provide the services of field testing agency or equipment manufacturer's representative to perform field data collection.

b. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

c. Available Existing Data:

D. Short-Circuit Study:

1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:

a. Maximum utility fault currents.

b. Maximum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:

1. Comply with applicable portions of IEEE 242 and IEEE 399.

2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. Analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.

F. Arc Flash and Shock Risk Assessment:

1. Comply with NFPA 70E.

2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.

a. To clarify IEEE 1584 statement that "equipment below 240 V need not be considered unless it involves at least one 125 kVA or larger low-impedance transformer in its immediate power supply" for purposes of studies, study preparer to include equipment rated less than 240 V fed by transformers less than 125 kVA in calculations.

b. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.

c. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 yielding conservative results.

3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.

4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:

a. Maximum and minimum utility fault currents.

b. Maximum and minimum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:
1. General Requirements:
a. Identify date of study and study preparer.
b. Identify study methodology and software product(s) used.
c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d. Identify base used for per unit values.
e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
f. Include conclusions and recommendations.
2. Short-Circuit Study:
a. For each scenario, identify at each bus location:
1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
2) Fault point X/R ratio.
3) Associated equipment short circuit current ratings.
b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
b. For each graph include (where applicable):
1) Partial single-line diagram identifying the portion of the system illustrated.
2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
3) Conductors: Damage curves.
4) Transformers: Inrush points and damage curves.
5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
6) Motors: Full load current, starting curves, and damage curves.
7) Capacitors: Full load current and damage curves.
c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
2) Include ground fault pickup and delay.
3) Include fuse ratings.
4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
a. For each scenario, identify at each bus location:
1) Calculated incident energy and associated working distance.
2) Calculated arc flash boundary.
3) Bolted fault current.
4) Arcing fault current.
5) Clearing time.

6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

c. Identify locations where the calculated maximum incident energy exceeds 40 calories per sq cm.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.
   1. Study preparer may be employed by the manufacturer of the electrical distribution equipment.
   2. Study preparer may be employed by field testing agency.
   3. Acceptable Study Preparers:

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
   1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
   1. Acceptable Software Products:
      a. EasyPower LLC: www.easypower.com/#sle.
      b. ETAP/Operation Technology, Inc: www.etap.com/#sle.
      c. Power Analytics Corporation: www.poweranalytics.com/#sle.
      d. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
   1. Materials: Comply with Section 260553.
   2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
      a. Include orange header that reads "WARNING" where calculated incident energy is less than 40 calories per square cm.
      b. Include red header that reads "DANGER" where calculated incident energy is 40 calories per square cm or greater.
      c. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
      d. Include the following information:
         1) Arc flash boundary.
         2) Available incident energy and corresponding working distance.
         3) Site-specific PPE (personnel protective equipment) requirements.
         4) Nominal system voltage.
         5) Limited approach boundary.
         6) Restricted approach boundary.
         7) Equipment identification.

8) Date calculations were performed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.
B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.
C. Inspect and test in accordance with NETA ATS, except Section 4.
D. Adjust equipment and protective devices for compliance with studies and recommended settings.
E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.
F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.03 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.
B. See Section 017900 - Demonstration and Training, for additional requirements.
C. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
    1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
    2. Provide minimum of eight hours of training.
    3. Instructor: Representative of entity performing study.
    4. Location: At project site.

3.04 ATTACHMENTS

A. Previous studies.
B. Existing drawings.

END OF SECTION

SECTION 260583
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
B. Section 260533.13 - Conduit for Electrical Systems.
C. Section 260533.16 - Boxes for Electrical Systems.
D. Section 262726 - Wiring Devices.
E. Section 262816.16 - Enclosed Switches.
F. Section 262913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.
B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.
B. Products: Listed, classified, and labeled as suitable for the purpose intended.
C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 262726.

D. Flexible Conduit: As specified in Section 260533.13.

E. Wire and Cable: As specified in Section 260519.

F. Boxes: As specified in Section 260533.16.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.
B. Outdoor motion sensors.
C. Time switches.
D. In-wall time switches.
E. In-wall interval timers.
F. Outdoor photo controls.
G. Daylighting controls.
H. Lighting contactors.
I. Control accessories.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.
B. Section 260529 - Hangers and Supports for Electrical Systems
C. Section 260533.16 - Boxes for Electrical Systems.
D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 260573 - Power System Studies.
F. Section 260918 - Remote Control Switching Devices: Remotely controlled devices for lighting control, including networked lighting controls, programmable relay panels, and remote control switching relays.
G. Section : Devices for manual control of lighting, including .
    1. Includes finish requirements for wall controls specified in this section.
    2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.
H. Section 262813 - Fuses.
I. Section 262913 - Enclosed Controllers : General purpose contactors.
J. Section 265100 - Interior Lighting.
K. Section 265561 - Theatrical Lighting: Controls for stage lighting units.
L. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.
B. 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; 2023.

C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2020.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.
H. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
I. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.
J. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.
K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.
M. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
N. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
O. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.
P. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
Q. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
R. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
   2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Locking Receptacle-Mounted Outdoor Photo Controls: Five percent of total quantity installed for each type, but not less than two of each type.
   3. Indicating Lights: Two of each different type.

H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

D. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   3. Sensor Switch Inc: www.sensorswitch.com/#sle.
   4. WattStopper: www.wattstopper.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.
   6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
      c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
      d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
   7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
   8. Sensitivity: Field adjustable.
   9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
   10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.

11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
14. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
15. Wireless Sensors:
    a. RF Range: 30 feet through typical construction materials.
    b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
    c. Power: Battery-operated with minimum ten-year battery life.

C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
    c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
    d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
    f. Provide selectable audible alert to notify occupant of impending load turn-off.
    g. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.
    h. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.
2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Wall Dimmer Occupancy Sensors:
1. General Requirements:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
    b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
    d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
    e. Provide field adjustable dimming preset for occupied state.
    f. Provide fade-to-off operation to notify occupant of impending load turn-off.

g. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.

2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
   a. Products:
      1) Lutron Maestro C.L Sensor Dimmer Series; www.lutron.com/#sle.
      2) Lutron Maestro Occupancy Sensor Dimmer Series; www.lutron.com/#sle.
      3) Lutron Maestro 0-10V Dimmer Sensor Series; www.lutron.com/#sle.
      4) Substitutions: See Section 016000 - Product Requirements.

E. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
      b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
      c. Provide field selectable setting for disabling LED motion detector visual indicator.
      d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      e. Finish: White unless otherwise indicated.
   2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
         1) Products:
            (a) Lutron LOS-CIR Series; www.lutron.com/#sle.
            (b) Lutron Radio Powr Savr Wireless Sensors; www.lutron.com/#sle.
      b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
         1) Products:
   3. Ultrasonic Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
         1) Products:
            (a) Lutron LOS-CUS Series; www.lutron.com/#sle.
      b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
         1) Products:
            (a) Lutron LOS-CUS Series; www.lutron.com/#sle.
      c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.
         1) Products:
            (a) Lutron LOS-CUS Series; www.lutron.com/#sle.
   4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
         1) Products:
            (a) Lutron LOS-CDT Series; www.lutron.com/#sle.
      b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
         1) Products:
            (a) Lutron LOS-CDT Series; www.lutron.com/#sle.
   5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.

F. Directional Occupancy Sensors:
1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
b. Provide field selectable setting for disabling LED motion detector visual indicator.
c. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Directional Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.

G. Luminaire Mounted Occupancy Sensors: Designed for direct luminaire installation and control, suitable for use with specified luminaires.

H. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on drawings.

I. Power Packs for Wireless Occupancy Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
2. Input Supply Voltage: Dual rated for 120/277 V ac.
3. Load Rating: As required to control the load indicated on drawings.

2.03 OUTDOOR MOTION SENSORS

A. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.

B. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.

C. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during an adjustable turn-off delay time interval.

D. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.

E. Integral Photocell: For dusk to dawn operation.

F. Manual Override: Activated by switching power off to unit and then back on.

G. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.

H. Coverage: Capable of detecting motion within a distance of 50 feet at a mounting height of 8 feet, with a field of view of 270 degrees.

2.04 TIME SWITCHES

A. Manufacturers:
1. Intermatic, Inc: www.intermatic.com/#sle.

2. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.
4. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
a. 24-Hour Time Switches: Single channel, with same schedule for each day of the week and skip-a-day feature to omit selected days.
b. 7-Day Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days.
c. Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Input Supply Voltage: As indicated on the drawings.
8. Output Switch Configuration: As required to control the load indicated on drawings.
9. Output Switch Contact Ratings: As required to control the load indicated on drawings.
10. Provide lockable enclosure; environmental type per NEMA EN 10250 as specified for the following installation locations:

2.05 IN-WALL TIME SWITCHES

2.06 IN-WALL INTERVAL TIMERS

2.07 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
1. Intermatic, Inc: www.intermatic.com/#sle.
2. Tork, a division of NSI Industries LLC: www.tork.com/#sle.

B. Stem-Mounted Outdoor Photo Controls:
1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.
9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

C. Locking Receptacle-Mounted Outdoor Photo Controls

1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.
8. Surge Protection: 160 joule metal oxide varistor.
9. Provide the following accessories where indicated or as required to complete installation:
   a. Receptacle: Complying with ANSI C136.10.
   b. Mounting Bracket.
   c. Shorting Cap: Suitable for replacing locking photo control to complete circuit.

2.08 DAYLIGHTING CONTROLS

A. Manufacturers:
   1. Hubbell Control Solutions: www.hubbell.com/hubbellcontrolsolutions/en/#sle.
   2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   3. Sensor Switch Inc: www.sensorswitch.com/#sle.
   4. WattStopper: www.wattstopper.com/#sle.

B. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
   1. Sensor Type: Filtered silicon photo diode.
   2. Sensor Range:
      a. Indoor Photo Sensors: 5 to 100 footcandles.
      b. Outdoor Photo Sensors: 5 to 250 footcandles.
      c. Atrium Photo Sensors: 200 to 2,500 footcandles.
      d. Skylight Photo Sensors: 1,000 to 6,000 footcandles.
      e. Open Loop Photo Sensors: 3 to 6,000 footcandles.
   3. Finish: White unless otherwise indicated.
   4. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
   5. Wireless Daylighting Control Photo Sensors:
      a. RF Range: 30 feet through typical construction materials.
      b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
      c. Power: Battery-operated with minimum ten-year battery life.
      d. Products:
         1) Lutron Radio Powr Savr Wireless Sensors; www.lutron.com/#sle.

D. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.

E. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
   2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
   3. Control Capability:
      a. Single Zone Switching Modules: Capable of controlling one programmable channel.
      b. Multi-Zone Switching Modules: Capable of controlling up to three separately programmable channels.

F. Daylighting Control Switching Modules for Wireless Sensors:
   1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected settings.
   2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
   3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
   4. Control Capability: Capable of controlling one programmable channel.
   5. Input Supply Voltage: Dual rated for 120/277 V ac.

G. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
   2. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
   3. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
   4. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.

H. Daylighting Control Dimming Modules for Wireless Sensors:
   1. Description: Plenum rated control unit compatible with specified wireless photo sensors and with specified dimming ballasts, for continuous dimming of compatible dimming ballasts in response to changes in measured light levels according to selected settings.
   2. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
   3. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
   4. Control Capability: Capable of controlling up to 32 ballasts with up to two separately programmable daylighting zones.

I. Power Packs for Low Voltage Daylighting Control Modules:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   2. Input Supply Voltage: Dual rated for 120/277 V ac.

3. Load Ratings: As required to control the load indicated on drawings.

J. Accessories:
1. Where indicated, provide compatible accessory wall switches for manual override control.
2. Where indicated, provide compatible accessory wireless controls for manual override control.
a. Products:
1) Lutron Pico Wireless Controls; www.lutron.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
1. Mounting Heights: Unless otherwise indicated, as follows:
a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
b. In-Wall Time Switches: 48 inches above finished floor.
c. In-Wall Interval Timers: 48 inches above finished floor.
2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.

G. Provide required supports in accordance with Section 260529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Identify lighting control devices in accordance with Section 260553.

J. Occupancy Sensor Locations:
   1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.

K. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

L. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

M. Daylighting Control Photo Sensor Locations:
   1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.
   2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
   3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

N. Combination Enclosed Lighting Contactors:
   1. Except where indicated to be mounted adjacent to the equipment they supply, mount lighting contactors such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

O. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

P. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

Q. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
   4. Location: At project site.

END OF SECTION

SECTION 261116
SECONDARY UNIT SUBSTATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Unit substation.

1.02 RELATED REQUIREMENTS

A. Section .

B. Section .
   1. Includes requirements for the seismic qualification of equipment specified in this section.

C. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2024.

B. IEC 60051-1 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 1: Definitions and General Requirements Common To All Parts; 2016.

C. IEC 60051-2 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 2: Special Requirements for Ammeters and Voltmeters; 2018.

D. IEEE 48 - IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV; 2020.

E. IEEE C37.04 - IEEE Standard for Ratings and Requirements for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V; 2018 (Corrigendum 2021).

F. IEEE C37.06 - IEEE Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities for Voltages Above 1000 V; 2009.

G. IEEE C37.20.1 - IEEE Standard for Metal-Enclosed Low-Voltage (1000 Vac and Below, 3200 Vdc and Below) Power Circuit Breaker Switchgear; 2015, with Amendment (2020).

H. IEEE C37.20.2 - IEEE Standard for Metal-Clad Switchgear; 2022.

I. IEEE C37.20.3 - IEEE Standard for Metal-Enclosed Interrupter Switchgear Rated above 1 kV AC up to and Including 48.3 kV AC; 2023.

J. IEEE C57.12.00 - IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers; 2021.

K. IEEE C57.12.01 - IEEE Standard for General Requirements for Dry-Type Distribution and Power Transformers; 2020.

L. IEEE C57.12.28 - IEEE Standard for Pad-Mounted Equipment--Enclosure Integrity; 2023.

M. IEEE C57.12.90 - IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers; 2021.

N. IEEE C57.12.91 - IEEE Standard Test Code for Dry-Type Distribution and Power Transformers; 2020.

O. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

P. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.

Q. IEEE C57.111 - IEEE Standard Guide for Acceptance of Silicone Insulating Fluid and Its Maintenance in Transformers; 1995 (Reaffirmed 2009).

R. IEEE C57.121 - IEEE Guide for Acceptance and Maintenance of Less-Flammable Hydrocarbon Fluid in Transformers; 1998 (Reaffirmed 2009).

S. NEMA TP 80049 - Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas; 2025.

T. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

U. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

V. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

W. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements, outline dimensions, connection and support points, weight, specified ratings and materials.
   1. Identify mounting conditions required for equipment seismic qualification.

C. Product Data: Provide electrical characteristics and connection requirements, standard model design tests, and options.

D. Manufacturer's equipment seismic qualification certification.

E. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

F. Manufacturer's Installation Instructions.

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

H. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.

I. Project Record Documents: Include copy of manufacturer's certified drawings.

J. Operation Data: Include operating instructions for manually and electrically opening and closing circuit breakers.

K. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended; instructions for circuit breaker removal, replacement, testing and adjustment, and lubrication; procedures for sampling and maintaining fluid.

L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fuses: Two of each type and size.
   3. Tools: Two each of every special tool required to operate and maintain unit substation.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect products from weather and moisture by covering with heavy plastic or canvas and by maintaining heating within enclosure in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

2.02 UNIT SUBSTATIONS

A. Description: Secondary unit substation comprising air terminal primary section, transformer section, and medium-voltage switchgear secondary section.

B. Configuration: Radial type , with indoor-outdoor arrangement.

C. Seismic Qualification: Provide unit substations and associated components suitable for application under the seismic design criteria specified in Section where required. Include certification of compliance with submittals.

2.03 SERVICE CONDITIONS

A. Meet requirements for usual service conditions and for the specified unusual service conditions.

2.04 PRIMARY CIRCUIT BREAKER RATINGS

2.05 TRANSFORMER RATINGS

2.06 INCOMING SECTION EQUIPMENT

A. Primary cover bushings.

B. Fused Air Interrupter Switch: IEEE C37.20.3, two position.

C. Metal-Clad Switchgear: IEEE C37.20.2.

D. Configuration: One incoming lines , looped.

E. Maximum Design Voltage: 5 kV.

F. Basic Impulse Level: 95 kV.

2.07 LIQUID-FILLED TRANSFORMERS

A. Liquid-Filled Transformers: IEEE C57.12.00, three phase, pad mounted, self-cooled transformer unit.

B. Cooling and Temperature Rise: IEEE C57.12.00; Class OA. 55 degrees C, self-cooled.

C. Insulating Liquid: Oil.

2.08 DRY TYPE TRANSFORMERS

A. Dry-Type Transformers: Single phase, pad-mounted, self-cooled transformer unit with solid-cast windings.

B. Cooling and Temperature Rise: IEEE C57.12.01; Class AA. 220 degree C insulation class with 150 degree C rise over 40 degree C ambient.

2.09 OUTGOING SECTION EQUIPMENT

A. Description: Switchboard manufactured to NEMA PB 2.

B. Line and Load Terminations: Accessible from the front only, suitable for the conductor materials used.

C. Main Section Devices: Panel mounted.

D. Distribution Section Devices: Panel mounted.

E. Auxiliary Section Devices: Individually mounted.

F. Bus Material: Copper.

G. Bus Connections: Bolted, accessible from front for maintenance.

H. Fully insulate bus bars throughout, with reduced bus spacing. Insulate using _____.

I. Fusible Switch Assemblies: NEMA BS 31047, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses, type as specified.

J. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse clips: Designed to accommodate Class L fuses.

K. Molded Case Circuit Breakers: Inverse time automatic tripping.

L. Field-Adjustable Trip Circuit Breaker: Provide circuit breakers with frame sizes 200 amperes and larger with mechanism for adjusting long time continuous current short time pickup current setting for automatic operation.
   1. Range of Adjustment: seconds.
   2. Field-Changeable Ampere Rating Circuit Breaker: Provide circuit breakers with frame sizes 200 amperes and larger with changeable trip units.
   3. Current Limiting Circuit Breaker: Provide circuit breaker as indicated with automatically-resetting current limiting elements in each pole. Let-through current and energy shall be less than permitted for same size Class RK-5 fuse.

M. Solid-State Circuit Breaker: Provide circuit breaker as indicated with electronic sensing, timing and tripping circuits for adjustable current settings; ground fault trip with integral ground fault sensing instantaneous trip; and adjustable short time trip.

N. Current Limiter: Designed for application with molded case circuit breaker.
   1. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.

2. Provide interlocks to trip circuit breaker and to prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiters is not in place or has operated.

O. Power Circuit Breakers: IEEE C37.20.1, factory-assembled electrically-operated low-voltage air circuit breakers, stationary mounting. Include electronic sensing, timing and tripping circuits for adjustable current, long-time pickup and long-time delay; ground-fault pickup and delay; adjustable instantaneous pickup; short-time pickup and delay. Ground fault sensing shall be integral with circuit breaker.

P. Fuses 600 Amperes and Less: Current limiting, dual element, time delay, one-time fuse, 250 volt, UL Class RK 1.

Q. Fuses 601 Amperes an Larger: Current limiting, time delay one time fuse, 600 volt, UL Class L.

2.10 POWER CIRCUIT BREAKERS AND CIRCUIT BREAKER SWITCHGEAR

2.11 PROTECTIVE RELAYS AND INSTRUMENTS

A. Protective Relays: Provide relaying instruments as indicated for each circuit breaker.

B. Current Transformers: IEEE C57.13, 5 ampere secondary, wound type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden consistent with connected metering and relay devices, 60 Hertz.

C. Potential Transformers: IEEE C57.13, 120 volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.

D. Analog Ammeters: IEC 60051-1 and IEC 60051-2, indicating ammeter with 4.5 inch square recessed case and 250 degree scale, white dial with black figures and pointer, 5 ampere, 60 Hertz movement, 1 percent accuracy.

E. Analog Voltmeters: IEC 60051-1 and IEC 60051-2, indicating voltmeter with 4.5 inch square recessed case and 250 degree scale, white dial with black figures and pointer, 120 volt, 60 Hertz movement, 1 percent accuracy.

F. Ammeter Transfer Switch: Rotary multistage snap-action type with 600 volt AC-DC silver plated contacts, engraved escutcheon plate, pistol-grip handle, and four positions including OFF.

G. Voltmeter Transfer Switch: Rotary multistage snap-action type with 600 volt AC-DC silver plated contacts, engraved escutcheon plate, pistol-grip handle, and four positions including OFF.

H. Watt-Hour Meters and Wattmeters: ANSI C12.1, three phase induction type with two stators, each with current and potential coil, rated 5 amperes and 120 volts at 60 Hertz. Meter suitable for connection to 3- and 4-wire circuits. Include potential indicating lamps; adjustments for light and full load, phase balance, and power factor; four-dial clock register; integral demand indicator; ratchets to prevent reverse rotation; removable meter with draw-out test plug; semi-flush mounted case with matching cover. Provide appropriate multiplier tags.

I. Impulse-Totalizing Demand Meter: ANSI C12.1; suitable for use with switchboard watt-hour meter, including two circuit totalizing relay; cyclometer; four dial totalizing kilowatt-hour register; positive chart drive mechanism; capillary pen holding minimum one-month ink supply; and a roll chart with minimum 31-day capacity. Indicate and record five minute integrated demand of the totalized system. Provide appropriate multiplier tags.

2.12 FABRICATION

A. Enclosure: Conform to the requirements of IEEE C57.12.28.

B. Construction: Indoor.

C. Main Bus: Aluminum.

END OF SECTION

SECTION 261200
MEDIUM-VOLTAGE TRANSFORMERS

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Liquid-filled pad-mounted distribution transformers.

2.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Pads for transformer support.

B. Section .

C. Section .
   1. Includes requirements for the seismic qualification of equipment specified in this section.

2.03 REFERENCE STANDARDS

A. IEEE 386 - IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV; 2016.

B. IEEE C37.47 - IEEE Standard Specifications for High-Voltage (>1000 V) Distribution Class Current-Limiting Type Fuses and Fuse Disconnecting Switches; 2011.

C. IEEE C57.12.00 - IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers; 2021.

D. IEEE C57.12.01 - IEEE Standard for General Requirements for Dry-Type Distribution and Power Transformers; 2020.

E. IEEE C57.12.28 - IEEE Standard for Pad-Mounted Equipment--Enclosure Integrity; 2023.

F. IEEE C57.12.90 - IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers; 2021.

G. IEEE C57.12.91 - IEEE Standard Test Code for Dry-Type Distribution and Power Transformers; 2020.

H. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

I. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.

J. IEEE C57.111 - IEEE Standard Guide for Acceptance of Silicone Insulating Fluid and Its Maintenance in Transformers; 1995 (Reaffirmed 2009).

K. IEEE C57.121 - IEEE Guide for Acceptance and Maintenance of Less-Flammable Hydrocarbon Fluid in Transformers; 1998 (Reaffirmed 2009).

L. NEMA TP 80049 - Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas; 2025.

M. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

2.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements, outline dimensions, connection and support points, weight, specified ratings and materials.
   1. Identify mounting conditions required for equipment seismic qualification.

C. Product Data: Provide electrical characteristics and connection requirements, standard model design tests, and options.

D. Manufacturer's equipment seismic qualification certification.

E. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

F. Manufacturer's Installation Instructions.

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

H. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.

I. Project Record Documents: Include copy of manufacturer's certified drawings.

J. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended ; procedures for sampling and maintaining fluid.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fuses: One of each type and size.
   3. Tools: One each of every special tool required to operate and maintain transformer.

2.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Testing Agency Qualifications: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

2.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dry-type transformers from moisture by using appropriate heaters as instructed by the manufacturer.

PART 2 PRODUCTS

3.01 MANUFACTURERS

A. ABB/GE www.geindustrial.com/#sle.

B. Cooper Power Systems, a division of Eaton Corporation: www.cooperindustries.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

3.02 LIQUID-FILLED TRANSFORMERS

A. Liquid-Filled Transformers: IEEE C57.12.00, three phase, pad-mounted, self-cooled transformer unit.

B. Cooling and Temperature Rise; IEEE C57.12.00; Class OA. 55 degrees C, self-cooled.

C. Insulating Liquid: Oil.

3.03 SERVICE CONDITIONS

A. Meet requirements for usual service conditions described in IEEE C57.12.00 and for the specified unusual service conditions.

3.04 RATINGS

A. Seismic Qualification: Provide transformers and associated components suitable for application under the seismic design criteria specified in Section where required. Include certification of compliance with submittals.

3.05 ACCESSORIES

A. Accessories: IEEE C57.12.00 standard accessories.

B. Tap Changer: Externally-operated type.

C. Primary Terminations: Bushing wells to IEEE 386; provide three for radial feed. Include bushings for insulated loadbreak connectors.

D. Primary Terminations: Porcelain insulator with clamp-type connector.

E. Primary Switching: Fused air switch, gang operated.

F. Primary Switching: Internal liquid-immersed gang-operated load break switch. Provide two, for primary selective switching.

G. Primary Overcurrent Protection: Internally-mounted, liquid-immersed, expulsion fuses.

H. Secondary Terminations: Spade lugs.

I. Secondary Switching and Overcurrent Protection: Molded case circuit breaker; UL listed.

J. Other Accessories: Primary lightning arrestors and secondary current transformers to IEEE C57.13.

3.06 FABRICATION

A. Conform to the requirements of IEEE C57.12.28.

3.07 FACTORY FINISHING

A. Clean surfaces before applying paint.

B. Apply corrosion-resisting primer to all surfaces.

C. Apply finish coat of baked enamel paint to 2 mils thick.

D. Finish Color: Manufacturer's standard dark gray finish.

3.08 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide factory tests to IEEE C57.12.91 and IEEE C57.12.01. Include the routine tests as defined in the standards and the following other tests:
   1. Impedance voltage and load loss.
   2. Dielectric tests.
   3. Audible sound level.
   4. Short circuit capability.
   5. Telephone influence factor (TIF).
   6. Zero-phase-sequence impedance voltage.
   7. Temperature rise.

C. Test insulating liquid samples in accordance with IEEE C57.111.

D. Make completed unit substation available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.

E. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner at least 7 days before inspections and tests are scheduled.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify that support pads provided under Section 033000 are ready to receive products.

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

4.02 INSTALLATION

A. Perform inspections and tests listed in NETA ATS, Section 7.2.

B. Install in accordance with IEEE C57.94.

C. Provide required support and attachment in accordance with Section .

D. Install plumb and level.

E. Install safety labels to NEMA TP 80049.

4.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.
   1. Liquid-Filled Transformers:

C. Perform inspections and tests listed in NETA ATS, Section 7.2. Tests listed as optional are not required.
   a. If core ground strap is accessible, remove and measure core insulation resistance at 500 volts dc.
   2. Liquid-Filled Transformers:
      a. Test dew point of tank gases.
      b. Perform sweep frequency response analysis tests.

c. Perform leakage reactance three phase equivalent and per phase tests.
d. If core ground strap is accessible, remove and measure core insulation resistance at 500 volts dc.
e. If applicable, measure the percentage of oxygen in the gas blanket.
f. Measure insulating liquid's specific gravity and dissipation factor or power factor.

4.04 ADJUSTING

A. Adjust primary taps so that secondary voltage is above and within 2 percent of rated voltage.

END OF SECTION

SECTION 261300
MEDIUM-VOLTAGE SWITCHGEAR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Circuit breaker switchgear.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Pads for transformer support.
B. Section 260529 - Hangers and Supports for Electrical Systems.
C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

1.03 REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2024.
B. IEC 60051-1 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 1: Definitions and General Requirements Common To All Parts; 2016.
C. IEC 60051-2 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 2: Special Requirements for Ammeters and Voltmeters; 2018.
D. IEEE 48 - IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV; 2020.
E. IEEE C37.04 - IEEE Standard for Ratings and Requirements for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V; 2018 (Corrigendum 2021).
F. IEEE C37.06 - IEEE Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities for Voltages Above 1000 V; 2009.
G. IEEE C37.20.1 - IEEE Standard for Metal-Enclosed Low-Voltage (1000 Vac and Below, 3200 Vdc and Below) Power Circuit Breaker Switchgear; 2015, with Amendment (2020).
H. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate electrical characteristics and connection requirements, outline dimensions, connection and support points, weight, specified ratings and materials.
   1. Identify mounting conditions required for equipment seismic qualification.
C. Product Data: Provide electrical characteristics and connection requirements, standard model design tests, and options.

D. Manufacturer's equipment seismic qualification certification.

E. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

F. Manufacturer's Installation Instructions.

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

H. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.

I. Project Record Documents: Include copy of manufacturer's certified drawings.

J. Operation Data: Include operating instructions for manually and electrically opening and closing circuit breakers.

K. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended; instructions for circuit breaker removal, replacement, testing and adjustment, and lubrication.

L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Tools: One each of every special tool required to operate and maintain switchgear.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect products from weather and moisture by covering with heavy plastic or canvas and by maintaining heating within enclosure in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

2.02 DESCRIPTION

A. Switchgear: IEEE C37.20.1, metal-clad switchgear assembly including horizontal draw-out circuit breakers in free-standing cubicles formed into an integrated structure.

2.03 SERVICE CONDITIONS

A. Meet requirements for usual service conditions described in IEEE C37.20.1 and for the specified unusual service conditions.

B. Meet requirements for use as service disconnecting means.

2.04 RATINGS

A. Seismic Qualification: Provide switchgear and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

B. Voltage and Insulation Levels: Conform to IEEE C37.20.1.

2.05 CIRCUIT BREAKERS

A. Circuit Breaker: IEEE C37.04, air-magnetic type.

B. Circuit Breaker Operator: Spring-charged stored energy with electric operator.

2.06 PROTECTIVE RELAYS AND INSTRUMENTS

A. Protective Relays: Provide relaying instruments as indicated for each circuit breaker.

B. Current Transformers: IEEE C57.13, 5 ampere secondary, wound type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden consistent with connected metering and relay devices, 60 Hertz.

C. Potential Transformers: IEEE C57.13, 120 volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.

D. Analog Ammeters: IEC 60051-1 and IEC 60051-2, indicating ammeter with 4.5 inch square recessed case and 250 degree scale, white dial with black figures and pointer, 5 ampere, 60 Hertz movement, 1 percent accuracy.

E. Analog Voltmeters: IEC 60051-1 and IEC 60051-2, indicating voltmeter with 4.5 inch square recessed case and 250 degree scale, white dial with black figures and pointer, 120 volt, 60 Hertz movement, 1 percent accuracy.

F. Ammeter Transfer Switch: Rotary multistage snap-action type with 600 volt AC-DC silver plated contacts, engraved escutcheon plate, pistol-grip handle, and four positions including OFF.

G. Voltmeter Transfer Switch: Rotary multistage snap-action type with 600 volt AC-DC silver plated contacts, engraved escutcheon plate, pistol-grip handle, and four positions including OFF.

H. Watt-Hour Meters and Wattmeters: ANSI C12.1, three phase induction type with two stators, each with current and potential coil, rated 5 amperes and 120 volts at 60 Hertz and with the following features:
   1. Suitable for connection to 3- and 4-wire circuits.
   2. Potential indicating lamps.
   3. Adjustments for light and full load, phase balance, and power factor.
   4. Four-dial clock register.
   5. Integral demand indicator.

6. Ratchets to prevent reverse rotation.
7. Removable meter with draw-out test plug.
8. Semi-flush mounted case with matching cover.
9. Appropriate multiplier tags.

I. Impulse-Totalizing Demand Meter: ANSI C12.1, with the following features:
1. Suitable for use with switchboard watt-hour meter, including two circuit totalizing relay.
2. Cyclometer.
3. Four dial totalizing kilowatt-hour register.
4. Positive chart drive mechanism.
5. Capillary pen holding minimum one-month ink supply.
6. Roll chart with minimum 31-day capacity.
7. 5 minute integrated demand.
8. Appropriate multiplier tags.

2.07 FABRICATION

A. Construction: Outdoor.

B. Main Bus: Aluminum.

2.08 FACTORY FINISHES

A. Clean surfaces before applying paint.

B. Apply corrosion-resisting primer to all surfaces.

C. Apply finish coat of baked enamel paint to 2 mils thick.

D. Finish Color: Manufacturer's standard gray finish.

2.09 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Test in accordance with IEEE C37.20.1.

C. Make completed unit substation available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.

D. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner at least 7 days before inspections and tests are scheduled.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support pads furnished under Section 033000 are ready to receive products.

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

3.02 INSTALLATION

A. Install in accordance with IEEE C37.20.1.

B. Provide required support and attachment in accordance with Section 260529.

C. Provide required seismic controls in accordance with Section 260548.

D. Install switchgear plumb and level and with each section aligned properly.

E. Make electrical connections between equipment sections using connectors furnished by manufacturer.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.1 .

D. Air Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.3. Tests listed as optional are not required.
   1. Perform mechanism-motion analysis.
   2. Perform trip/close coil current signature analysis.
   3. Perform insulation-resistance tests on all control wiring with respect to ground.
   4. Perform power-factor or dissipation-factor tests with breaker in both the open and closed positions.
   5. Perform power-factor or dissipation-factor tests on each bushing equipped with a power-factor/capacitance tap.

E. Vacuum Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.3. Tests listed as optional are not required.
   1. Perform trip/close coil current signature analysis.
   2. Perform mechanism-motion analysis.
   3. Perform insulation-resistance tests on all control wiring with respect to ground.
   4. Perform power-factor or dissipation-factor tests on each pole with the breaker open and each phase with the breaker closed.
   5. Perform power-factor or dissipation-factor tests on each bushing equipped with a power-factor/capacitance tap.
   6. Perform magnetron atmospheric condition (MAC) test on each vacuum interrupter.

3.04 ADJUSTING

A. Adjust protective relays in accordance with recommendations in Owner's coordination study.

B. Adjust protective relays as directed.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of circuit breakers.

END OF SECTION

SECTION 262100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.
B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
C. Section 260526 - Grounding and Bonding for Electrical Systems.
D. Section 260529 - Hangers and Supports for Electrical Systems.
E. Section 260533.13 - Conduit for Electrical Systems.
F. Section 260533.23 - Surface Raceways for Electrical Systems: Wireways.
G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
H. Section 262300 - Low-Voltage Switchgear: Service entrance equipment.
I. Section 262413 - Switchboards: Service entrance equipment.
J. Section 262416 - Panelboards: Service entrance equipment.
K. Section 262713 - Electricity Metering: Non-utility electrical metering.

1.03 PRICE AND PAYMENT PROCEDURES

A. Allowances:
    1. See Section 012100 - Allowances, for allowances affecting this section.
    2. Include cash allowance for Utility Company charges associated with providing service.
B. Unit Prices:
    1. See Section 012200 - Unit Prices, for additional unit price requirements.
    2. Primary:
        a. Basis of Measurement: By the lineal foot, for each configuration.
        b. Basis of Payment: Includes all work designated to be provided by Contractor in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
    3. Secondary:
        a. Basis of Measurement: By the lineal foot, for each configuration.
        b. Basis of Payment: Includes all work designated to be provided by Contractor in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
    4. Transformer Pad/Vault:
        a. Basis of Measurement: Per unit, for each type.
        b. Basis of Payment: Includes purchase, delivery, and installation.

1.04 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.05 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.06 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Owner.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:
   1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.08 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: As indicated on drawings.

D. Division of Responsibility: As indicated on drawings.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment components in accordance with Section 260529.

E. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.

F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 262200
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section .

C. Section 260533.13 - Conduit for Electrical Systems: Flexible conduit connections.

D. Section .
   1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262416 - Panelboards.

G. Section 262713 - Electricity Metering: Instrument transformers for electrical metering.

1.03 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.

C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers; 2013.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.

F. NEMA ST 20 - Dry Type Transformers for General Applications; 2021.

G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
   1. Vibration Isolators: Include attachment method and rated load and deflection.

C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

D. Manufacturer's equipment seismic qualification certification.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Maintenance Data: Include recommended maintenance procedures and intervals.

I. Project Record Documents: Record actual locations of transformers.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
   1. Greater than 10 kVA: 104 degrees F maximum.

2. Less than 10 kVA: 77 degrees F maximum.

B. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
1. Altitude: Less than 3,300 feet.
2. Ambient Temperature:
a. Greater than 10 kVA: Not exceeding 104 degrees F.
b. Less than 10 kVA: Not exceeding 77 degrees F.
3. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Insulation System and Allowable Average Winding Temperature Rise:
   1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
   2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

E. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

F. Winding Taps:
   1. Less than 3 kVA: None.
   2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
   3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
   4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

H. Sound Levels: Standard sound levels complying with NEMA ST 20

I. Mounting Provisions:
   1. Less than 15 kVA: Suitable for wall mounting.
   2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   2. Construction: Steel.
      a. Less than 15 kVA: Totally enclosed, non-ventilated.
      b. 15 kVA and Larger: Ventilated.
   3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
   4. Provide lifting eyes or brackets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Provide seismic restraints.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install transformers in accordance with NECA 409 and IEEE C57.94.

E. Use flexible conduit, under the provisions of Section 260533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

F. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

G. Install transformers plumb and level.

H. Transformer Support:
   1. Provide required support and attachment in accordance with Section , where not furnished by transformer manufacturer.
   2. Use to support wall-mounted transformers.
   3. Unless otherwise indicated, mount floor-mounted transformers on properly sized high concrete pad constructed in accordance with Section .
   4. Use to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

I. Provide grounding and bonding in accordance with Section 260526.

J. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

K. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.
   1. 167 kVA single phase, 500 kVA three phase and smaller:
      a. Perform turns ratio tests at all tap positions.
   2. Larger than 167 kVA single phase and 500 kVA three phase:
      a. Verify that control and alarm settings on temperature indicators are as specified.
      b. Perform excitation-current tests on each phase.
      c. Measure the resistance of each winding at each tap connection.
      d. Perform an applied voltage test on all high- and low-voltage windings-to-ground.

3.04 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262300
LOW-VOLTAGE SWITCHGEAR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low-voltage (600 V and less) arc-resistant metal-enclosed drawout switchgear and accessories for service and distribution applications.

B. Low-voltage power circuit breakers for switchgear.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 262100 - Low-Voltage Electrical Service Entrance.
   1. Includes Utility Company contact information.

H. Section 262413 - Switchboards.

I. Section 262419 - Motor-Control Centers.

J. Section 262513 - Low-Voltage Busways.

K. Section 262713 - Electricity Metering: For interface with equipment specified in this section.

L. Section 262813 - Fuses: Fuses for fusible switches.
   1. Includes requirements for spare fuses and spare fuse cabinets.

M. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. ANSI C37.50 - American National Standard for Switchgear - Low Voltage AC Power Circuit Breakers Used In Enclosures - Test Procedures; 2018.

B. ANSI C37.51 - American National Standard for Switchgear - Metal-Enclosed Low Voltage AC Power Circuit Breaker Switchgear Assemblies - Conformance Test Procedures; 2018.

C. IEEE C37.13 - IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures; 2015.

D. IEEE C37.16 - IEEE Standard for Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage AC (635 V and below) and DC (3200 V and below) Power Circuit Breakers; 2009.

E. IEEE C37.17 - IEEE Standard for Trip Systems for Low-Voltage (1000 V and below) AC and General Purpose (1500 V and below) DC Power Circuit Breakers; 2022.

F. IEEE C37.20.1 - IEEE Standard for Metal-Enclosed Low-Voltage (1000 Vac and Below, 3200 Vdc and Below) Power Circuit Breaker Switchgear; 2015, with Amendment (2020).

G. IEEE C37.20.7 - IEEE Guide for Testing Switchgear Rated up to 52 kV for Internal Arcing Faults; 2017 (Corrigendum 2021).

H. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

J. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

K. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

O. UL 1066 - Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures; Current Edition, Including All Revisions.

P. UL 1558 - Switchgear; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
   5. Notify Architect of any conflicts with or deviations Contract Documents. Obtain direction before proceeding with work.

B. Service Entrance Switchgear:
   1. Coordinate with Utility Company to provide switchgear with suitable provisions for electrical service and utility metering, where applicable.
   2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
   3. See Section 262100 for Utility Company contact information and additional requirements.
   4. Obtain Utility Company approval of switchgear prior to fabrication.
   5. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
   6. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchgear, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, short-time current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of switchgear and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Include documentation demonstrating selective coordination upon request.
   4. Include key-type mechanical interlock scheme with sequence of operations, as applicable.
   5. Include proposed mimic bus single-line diagram arrangement.
   6. Arc-Resistant Switchgear: Include proposed plenum arrangement, where applicable.
   7. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Service Entrance Switchgear: Include documentation of Utility Company approval of switchgear.

F. Source Quality Control Test Reports: Include reports for tests designated in IEEE C37.20.1 as production tests.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Field Quality Control Test Reports.

I. Project Record Documents: Record actual installed locations of switchgear and final equipment settings.

J. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Enclosure Keys: Two of each different key.
   3. Circuit Breakers:
      a. Handles Necessary for Racking of Devices: One for each electrical room containing drawout switchgear.
      b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout switchgear.
      c. Removable Covers: One for blocking each different opening size when circuit breaker is temporarily removed from its compartment.
   4. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchgear in accordance with manufacturer's instructions and IEEE C37.20.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchgear, which is not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchgear internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Low-Voltage Switchgear - Basis of Design.

B. Low-Voltage Switchgear - Other Acceptable Manufacturers:
   1. ABB/GE: www.geindustrial.com/#sle.
   2. Eaton Corporation: www.eaton.com/#sle.
   3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
   4. Siemens Industry, Inc: www.usa.siemens.com/#sle.

C. Substitutions: See Section 016000 - Product Requirements.

2.02 LOW-VOLTAGE SWITCHGEAR

A. Provide switchgear assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front standard (non-arc-resistant) type metal-enclosed drawout switchgear complying with IEEE C37.20.1 and ANSI C37.51; listed and labeled as complying with UL 1558; ratings, configurations and features as indicated on the drawings.

D. Configuration:
   1. Compartmentalization: Provide barriered compartments for each overcurrent protective device, distribution bus, and rear cable connection area.
   2. Arrangement: Rear accessible, front and rear aligned.
   3. Rear Access: Bolted covers.

E. Arc-Resistance Rating:
   1. Passes criteria for arc-resistant functionality when tested in accordance with applicable requirements of IEEE C37.20.7 for Type 2 accessibility.
   2. Arc exhaust gases must be discharged through a plenum into designated area approved by Architect.
   3. Arc resistant rating valid through maximum current of not less than the available fault current at the installed location.

F. Service Entrance Switchgear:

1. Listed and labeled as suitable for use as service equipment according to UL 869A.
2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
3. Comply with Utility Company requirements for electrical service.
4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
5. See Section 262100 for additional requirements.

G. Switchgear With Busway Transitions: Configured for bussed connection to busway provided in accordance with Section 262513.

H. Switchgear With Fire Pump Taps: Provide separate bussed vertical section with suitable lugs for fire pump connection to line side of main service disconnect device(s).

I. Provide integral top rail-mounted lifting device where indicated.

J. Seismic Qualification: Provide switchgear and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

K. Service Conditions:
1. Provide switchgear and associated components suitable for operation under the following service conditions without derating:
   a. Altitude: Less than 6,600 feet.
   b. Ambient Temperature: Between -22 degrees F and 104 degrees F.
2. Provide switchgear and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

L. Short Circuit Current Rating:
1. Provide switchgear with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

M. Short-Time Current (30-Cycle Withstand) Rating: Equivalent to specified short circuit current rating.

N. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

O. Bussing: Sized in accordance with UL 1558 temperature rise requirements.
1. Main bus (horizontal cross bus) to be fully rated through full length of switchgear.
2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
3. Provide solidly bonded equipment ground bus through full length of switchgear, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Phase and Neutral Bus Material: Copper.
5. Ground Bus Material: Copper.

P. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
   a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Main and Neutral Lug Type: Mechanical.
2. Load Conductor Terminations:
   a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Lug Type:

Q. Enclosures:

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
2. Finish: Manufacturer's standard unless otherwise indicated.
3. Enclosure Space Heaters:
   a. Provide in each switchgear section installed outdoors and in unconditioned indoor spaces.
   b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
   c. Heater Control: Thermostat.
   d. Heater Power Source: Provide connection to transformer factory-installed in switchgear or suitable external branch circuit as indicated or as required.
4. Outdoor Enclosures:
   a. Enclosure Type: Non-walk-in type unless otherwise indicated.
   b. Color: Manufacturer's standard.
   c. Access Doors: Lockable, with all locks keyed alike.
   d. Walk-in Enclosure Features:
      1) Personnel Doors: Open to exterior; equipped with panic hardware.
      2) Aisle lighting, with switch at each access door.
      3) GFCI duplex convenience receptacle.

R. Future Provisions:
   1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
   2. Arrange and equip through bus and ground bus to accommodate future installation of additional switchgear sections.

S. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchgear as a complete assembly including surge protective device.

T. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Provide separate neutral current sensor where applicable.

U. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

V. Owner Metering: Comply with Section 262713.

W. Owner Metering:
   1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
   2. Measured Parameters:
      a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
      b. Current (Amps): For each phase and neutral.
      c. Frequency (Hz).
      d. Real power (kW): For each phase, 3-phase total.
      e. Reactive power (kVAR): For each phase, 3-phase total.
      f. Apparent power (kVA): For each phase, 3-phase total.
      g. Power factor.
      h. Real energy (kWh).
      i. Reactive energy (kVARh).
      j. Apparent energy (kVAh).

k. Current demand.
l. Power demand: Real, reactive, and apparent.

3. Meter Accuracy: Plus/minus 1.0 percent.
4. Features:
   a. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
   b. KYZ pulse output.
   c. Adjustable demand interval.
   d. Remote monitoring capability via PC.

X. Instrument Transformers:
1. Comply with IEEE C57.13.
2. Select suitable ratio, burden, and accuracy as required for connected devices.
3. Current Transformers: Connect secondaries to shorting terminal blocks.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 LOW-VOLTAGE POWER CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, trip-free low-voltage power circuit breakers with two-step stored energy closing mechanism; 100 percent rated; complying with IEEE C37.13, IEEE C37.16, IEEE C37.17, and ANSI C37.50; listed and labeled as complying with UL 1066; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity: Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.

C. Operation:
1. Provide manually operated circuit breakers unless otherwise indicated.
2. Provide electrically operated circuit breakers where indicated.
3. Pad-Lock Provision: For preventing circuit breaker closing operation.

D. Construction: Drawout.
1. Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
2. Provide safety interlock to prevent racking of circuit breaker while in the ON position.
3. Pad-Lock Provision: For preventing circuit breaker drawout operation.

E. Fused Circuit Breakers:
1. Fuses: Class L, selected for coordination with circuit breaker trip units.
2. Blown Fuse Protection: Provide blown fuse protection to trip circuit breaker in the event of the opening, or absence, of a fuse and to prevent closing of circuit breaker until reset operation is performed; provide blown fuse status indication.
3. Where fuse is not integral with circuit breaker and mounted in a separate compartment, provide interlock to prevent fuse access with the circuit breaker in the ON position.

F. Trip Units: Solid state, microprocessor-based, true rms sensing.
1. Provide the following field-adjustable trip response settings:
   a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
   b. Long time delay.
   c. Short time pickup and delay.
   d. Instantaneous pickup.
      1) Include instantaneous function for feeder circuit breakers.
      2) Omit instantaneous function or provide ability to turn instantaneous function off for main and tie circuit breakers.
   e. Ground fault pickup and delay where ground fault protection is indicated.

2. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
3. Provide communication capability where indicated: Compatible with system indicated.

G. Provide the following features and accessories where indicated or where required to complete installation:
1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
3. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
4. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
5. Truck-Operated Cell Switch: For indicating circuit breaker racking position.

2.04 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory test switchgear according to IEEE C37.20.1, including the following production tests on each switchgear assembly or component:
1. Dielectric tests.
2. Mechanical operation tests.
3. Grounding of instrument transformer cases test.
4. Electrical operation and control wiring tests, including polarity and sequence tests.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the switchgear and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchgear.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchgear in accordance with NECA 1 (general workmanship) and IEEE C37.20.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for drawout circuit breakers.

D. Provide required support and attachment in accordance with Section 260529.

E. Install switchgear plumb and level.

F. Unless otherwise indicated, mount switchgear on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.

G. Provide grounding and bonding in accordance with Section 260526.

H. Install all field-installed devices, components, and accessories.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable circuit breaker tripping function settings as indicated.

K. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

L. Identify switchgear in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Before energizing switchgear, perform preoperation checks in accordance with IEEE C37.20.1.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.1.

G. Low-Voltage Power Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.2 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

H. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

I. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

J. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

K. Test shunt trips to verify proper operation.

L. Correct deficiencies and replace damaged or defective switchgear assemblies or associated components.

M. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchgear covers and doors.

3.05 CLEANING

A. Clean dirt and debris from switchgear enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchgear and associated devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.07 PROTECTION

A. Protect installed switchgear assemblies from subsequent construction operations.

END OF SECTION

SECTION 262413
SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section .
   1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 262100 - Low-Voltage Electrical Service Entrance.
   1. Includes Utility Company contact information.

H. Section 262300 - Low-Voltage Switchgear.

I. Section 262513 - Low-Voltage Busways.

J. Section 262813 - Fuses: Fuses for fusible switches.
   1. Includes requirements for spare fuses and spare fuse cabinets.

K. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.

E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

F. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

G. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

H. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 1000 Volts or Less; 2023.

I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 891 - Switchboards; Current Edition, Including All Revisions.

O. UL 977 - Fused Power-Circuit Devices; Current Edition, Including All Revisions.

P. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the electrical outage time with the school district for crossover of power when the new switchboard is installed. Do not discionnect power from the school without written authorization.Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   3. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
   6. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:
   1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
   2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
   3. Obtain Utility Company approval of switchboard prior to fabrication.
   4. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.

2. Include wiring diagrams showing all factory and field connections.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings upon request.
5. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.

F. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Field Quality Control Test Reports.

I. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

J. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Enclosure Keys: Two of each different key.
3. Electronic Trip Circuit Breakers: Provide one portable test set.
4. Drawout Devices:
   a. Handles Necessary for Racking of Devices: One for each electrical room containing switchgear with drawout devices.
   b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout devices.
   c. Portable Lifting Devices: One for each electrical room containing switchboards with drawout devices and no integral top rail-mounted lifting device.
   d. Removable Covers: One for blocking each different opening size when device is temporarily removed from its compartment.
5. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Switchboards:
   1. ABB/GE; _____: www.geindustrial.com/#sle.
   2. Eaton Corporation; _____: www.eaton.com/#sle.
   3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
   4.

B. Substitutions: See Section 016000 - Product Requirements.

C. Products by Siemens Industry are not permitted.

D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

E. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 SWITCHBOARDS

A. Switchboard shall be provided with weatherproof enclosure suitable for outdoor location as required.

B. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

E. Front-Connected Switchboards:
   1. Main Device(s): Individually-mounted.
   2. Feeder Devices: Panel/group-mounted.
   3. Arrangement: Front accessible only (not rear accessible), rear aligned.
   4. Gutter Access: Bolted covers.

F. Service Entrance Switchboards:
   1. Listed and labeled as suitable for use as service equipment according to UL 869A.

2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
3. Comply with Utility Company requirements for electrical service.
4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
5. See Section 262100 for additional requirements.

G. Switchboards With Busway Transitions: Configured for bussed connection to busway provided in accordance with Section 262513.

H. Switchboards With Fire Pump Taps: Provide separate bussed vertical section with suitable lugs for fire pump connection to line side of main service disconnect device(s).

I. Switchboards With Drawout Devices: Provide integral top rail-mounted lifting device where indicated.

J. Seismic Qualification: Provide switchboards and associated components suitable for application under the seismic design criteria specified in Section where required. Include certification of compliance with submittals.

K. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
a. Altitude: Less than 6,600 feet.
b. Ambient Temperature:
1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
2) Switchboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.
2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

L. Short Circuit Current Rating:
1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
3. Minimum Rating: 65,000 rms symmetrical amperes.
4. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
5. Label equipment utilizing series ratings as required by NFPA 70.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

N. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

O. Bussing: Sized in accordance with UL 891 temperature rise requirements.
1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

4. Phase and Neutral Bus Material: Aluminum.
5. Ground Bus Material: Aluminum.

P. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
   a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Main and Neutral Lug Type: Mechanical.
2. Load Conductor Terminations:
   a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Lug Type:
      1) Provide mechanical lugs unless otherwise indicated.
      2) Provide compression lugs where indicated.

Q. Enclosures:
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
   b. Outdoor Locations: Type 3R.
2. Finish: Manufacturer's standard unless otherwise indicated.
3. Enclosure Space Heaters:
   a. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
   b. Heater Control: Thermostat.
   c. Heater Power Source: Provide connection to transformer factory-installed in switchboard or suitable external branch circuit as indicated or as required.
4. Outdoor Enclosures:
   a. Enclosure Type: Non-walk-in type unless otherwise indicated.
   b. Color: Manufacturer's standard.
   c. Access Doors: Lockable, with all locks keyed alike.
   d. Walk-in Enclosure Features:
      1) Personnel Doors: Open to exterior; equipped with panic hardware.
      2) Aisle lighting, with switch at each access door.
      3) GFCI duplex convenience receptacle.

R. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.

S. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchboards as a complete assembly including surge protective device.

T. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
   a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
   b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

U. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

V. Instrument Transformers:
1. Comply with IEEE C57.13.
2. Select suitable ratio, burden, and accuracy as required for connected devices.
3. Current Transformers: Connect secondaries to shorting terminal blocks.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Devices:
1. Fusible Switches:
a. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA BS 31047, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
b. Fuse Clips: As required to accept indicated fuses.
1) Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
c. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
2. Fused Power-Circuit Devices:
a. Description: Quick-make, quick-break, dead-front bolted-pressure contact switches and high-pressure butt contact switches listed and labeled as complying with UL 977; ratings, configurations, and features as indicated on the drawings.
b. Bolted-Pressure Contact Switches: Devices with additional pressure or clamping action provided at both ends of switch blades when blades are in the fully closed position.
c. High-Pressure Butt Contact Switches: Devices with butt-type contacts and spring-charged mechanism.
d. Minimum Short Circuit Current Rating: 200,000 rms symmetrical amperes when protected by Class L fuses.
e. Fuse Clips: As required to accept Class L fuses.
f. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
g. Provide the following features and accessories where indicated or where required to complete installation:
1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating switch position.
3) Blown fuse protection and indication.

B. Circuit Breakers:
1. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.

2. Molded Case Circuit Breakers:
   a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
      1) Provide thermal magnetic circuit breakers unless otherwise indicated.
      2) Provide electronic trip circuit breakers where indicated.
   b. Minimum Interrupting Capacity:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
      2) Provide interchangeable trip units where indicated.
   d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      1) Provide the following field-adjustable trip response settings:
         (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         (b) Long time delay.
         (c) Short time pickup and delay.
         (d) Instantaneous pickup.
         (e) Ground fault pickup and delay where ground fault protection is indicated.
      2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
      3) Provide communication capability where indicated: Compatible with system indicated.
   e. Provide the following circuit breaker types where indicated:
      1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
      2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
   f. Provide the following features and accessories where indicated or where required to complete installation:
      1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
      2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
      3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

3. Insulated Case Circuit Breakers:
   a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
   b. Operation:
      1) Provide manually operated circuit breakers unless otherwise indicated.
      2) Provide electrically operated circuit breakers where indicated.
      3) Pad-Lock Provision: For preventing circuit breaker closing operation.
   c. Construction:
      1) Provide fixed-mount circuit breakers unless otherwise indicated.
      2) Provide drawout circuit breakers where indicated.
   d. Drawout Circuit Breakers:
      1) Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
      2) Provide safety interlock to prevent racking of circuit breaker while in the ON position.
      3) Pad-Lock Provision: For preventing circuit breaker drawout operation.
   e. Minimum Interrupting Capacity:
      1) 42,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 65,000 rms symmetrical amperes at 480 VAC.
   f. Trip Units: Solid state, microprocessor-based, true rms sensing.
      1) Provide the following field-adjustable trip response settings:
         (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         (b) Long time delay.
         (c) Short time pickup and delay.
         (d) Instantaneous pickup.
         (e) Ground fault pickup and delay where ground fault protection is indicated.
      2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
      3) Provide communication capability where indicated: Compatible with system indicated.
   g. Provide the following circuit breaker types where indicated:
      1) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
   h. Provide the following features and accessories where indicated or where required to complete installation:
      1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
      2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
      3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

4) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.04 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
   1. Dielectric tests.
   2. Mechanical operation tests.
   3. Grounding of instrument transformer cases test.
   4. Electrical operation and control wiring tests, including polarity and sequence tests.
   5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.

E. Provide required support and attachment in accordance with Section .

F. Provide required seismic controls in accordance with Section .

G. Install switchboards plumb and level.

H. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.

I. Provide grounding and bonding in accordance with Section 260526.

J. Install all field-installed devices, components, and accessories.

K. Provide fuses complying with Section 262813 for fusible switches as indicated.

L. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

M. Set field-adjustable circuit breaker tripping function settings as indicated.

N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

O. Provide filler plates to cover unused spaces in switchboards.

P. Identify switchboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.1.

G. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

H. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

I. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

J. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

K. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

L. Test shunt trips to verify proper operation.

M. Correct deficiencies and replace damaged or defective switchboards or associated components.

N. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

3.05 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

C. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.07 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section .
   1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 262200 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

H. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

I. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

F. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

G. NEMA PB 1 - Panelboards; 2011.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

M. UL 67 - Panelboards; Current Edition, Including All Revisions.

N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

P. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

Q. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

R. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

S. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings upon request.
   5. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

E. Products by Siemens Industry are not permitted

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section where required. Include certification of compliance with submittals.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

H. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
   3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
      c. Provide removable end walls for NEMA Type 1 enclosures.
      d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.

M. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
   1. Ampere Rating: Not less than ampere rating of panelboard bus.
   2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
   3. Coil Voltage: As required for connection to control system indicated.

N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

O. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

P. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

Q. Provide the following features and accessories where indicated or where required to complete installation:
   1. Feed-through lugs.
   2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Aluminum.
   2. Ground Bus Material: Aluminum.

D. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
   2. Provide thermal magnetic circuit breakers unless otherwise indicated.
   3. Provide electronic trip circuit breakers where indicated.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
   3. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.

4. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
5. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Aluminum.
3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA BS 31047, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
4. Conductor Terminations:
a. Provide compression lugs unless otherwise indicated.
b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

B. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
2) 14,000 rms symmetrical amperes at 480 VAC.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:
   a. Provide compression lugs unless otherwise indicated.
   b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   b. Provide interchangeable trip units where indicated.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:
      1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.
   b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
   c. Provide communication capability where indicated: Compatible with system indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
8. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.
12. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
13. Provide the following features and accessories where indicated or where required to complete installation:
   a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
   c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
   d. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.06 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section .

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 260526.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
   2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

L. Install all field-installed branch devices, components, and accessories.

M. Provide fuses complying with Section 262813 for fusible switches as indicated.

N. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

O. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

P. Set field-adjustable circuit breaker tripping function settings as indicated.

Q. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.

R. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

S. Provide filler plates to cover unused spaces in panelboards.

T. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

U. Identify panelboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

F. Test GFCI circuit breakers to verify proper operation.

G. Test AFCI circuit breakers to verify proper operation.

H. Test shunt trips to verify proper operation.

I. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

J. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262419
MOTOR-CONTROL CENTERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low-voltage (600 V and less) standard (non-arc-resistant) NEMA motor control centers.
B. Low-voltage (600 V and less) arc-resistant NEMA motor control centers.
C. Motor control center units:
    1. Feeder units.
    2. Combination magnetic motor starter units.
D. Overcurrent protective devices for motor control centers and associated units, including overload relays.
E. Motor control accessories:
    1. Auxiliary contacts.
    2. Pilot devices.
    3. Control and timing relays.
    4. Control power transformers.
    5. Control terminal blocks.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
B. Section 260526 - Grounding and Bonding for Electrical Systems.
C. Section 260529 - Hangers and Supports for Electrical Systems.
D. Section .
E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
F. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
G. Section 262100 - Low-Voltage Electrical Service Entrance.
    1. Includes Utility Company contact information.
H. Section 262200 - Low-Voltage Transformers: For integration into equipment specified in this section, where indicated.
I. Section 262416 - Panelboards: For integration into equipment specified in this section, where indicated.
J. Section 262813 - Fuses: Fuses for fusible switches.
    1. Includes requirements for spare fuses and spare fuse cabinets.
K. Section 262923 - Variable-Frequency Motor Controllers.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).
B. IEEE C37.20.7 - IEEE Guide for Testing Switchgear Rated up to 52 kV for Internal Arcing Faults; 2017 (Corrigendum 2021).

C. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
E. NECA 402 - Standard for Installing and Maintaining Motor Control Centers; 2020.
F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
G. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
H. NEMA IA 10028 - Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers Rated Not More than 600 V; 2024.
I. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.
J. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.
K. NEMA ICS 18 - Motor Control Centers; 2001 (Reaffirmed 2007).
L. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
M. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
O. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
P. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
Q. UL 845 - Motor Control Centers; Current Edition, Including All Revisions.
R. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
S. UL 977 - Fused Power-Circuit Devices; Current Edition, Including All Revisions.
T. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
   3. Coordinate the work to provide motor controllers and associated wiring suitable for interface with control devices to be installed.
   4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   6. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
   7. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Service Entrance Motor Control Centers:
   1. Coordinate with Utility Company to provide motor control centers with suitable provisions for electrical service.
   2. See Section 262100 for Utility Company contact information and additional requirements.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor control centers, enclosures, units, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
   2. Arc-Resistant Motor Control Centers: Indicate IEEE C37.20.7 accessibility type, and maximum fault current and arc duration.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, unit arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of motor control centers and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings upon request.
   5. Include documentation demonstrating selective coordination upon request.
   6. Arc-Resistant Motor Control Centers: Include proposed plenum arrangement, where applicable.
   7. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Field Quality Control Test Reports.

G. Project Record Documents: Record actual installed locations of motor control centers and final equipment settings.
   1. Include nameplate data of actual installed motors and associated overload relay selections and settings.
   2. Motor Circuit Protectors: Include magnetic instantaneous trip settings.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Enclosure Keys: Two of each different key.
   3. Electronic Trip Circuit Breakers: Provide one portable test set.
   4. Indicating Lights: Two of each different type.
   5. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store motor control centers in accordance with manufacturer's instructions, NECA 402, and NEMA ICS 2.3.

B. Store in a clean, dry space having a uniform temperature to prevent condensation. Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

2.02 MOTOR CONTROL CENTER UNITS

A. Feeder Units: Circuit breaker type.

B. Combination Magnetic Motor Starter Units:
   1. Description: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
   2. Configuration: Full-voltage non-reversing type unless otherwise indicated.
   3. Use of non-standard starter sizes smaller than specified standard NEMA sizes is not permitted.
   4. Disconnects: Circuit breaker type.
      a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
      b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
      c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
   5. Overload Relays: Bimetallic thermal type unless otherwise indicated.
   6. Pilot Devices Required:
      a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
      b. Single-Speed, Non-Reversing Starters:
         1) Pushbuttons: START-STOP.
         2) Selector Switches: HAND/OFF/AUTO.

3) Indicating Lights: Red ON, Green OFF.

c. Single-Speed, Reversing Starters:
1) Pushbuttons: FOR-REV-STOP.
2) Selector Switches: FOR/OFF/REV.
3) Indicating Lights: Red FOR, Red REV, Green OFF.

d. Two-Speed Starters:
1) Pushbuttons: FAST-OFF-SLOW.
2) Selector Switches: SLOW/OFF/FAST.
3) Indicating Lights: Red FAST, Red SLOW, Green OFF.

C. Variable-Frequency AC Drive Units: Comply with Section 262923.

D. Distribution Equipment Units: Where incorporation of low-voltage distribution equipment within motor control center units is indicated, provide suitable components complying with applicable specified requirements.
1. Low-Voltage Transformers: See Section 262200.
2. Panelboards: See Section 262416.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
3. Trip-free operation.
4. Visible trip indication.
5. Resettable.
a. Employ manual reset unless otherwise indicated.
b. Employ automatic reset or remote reset where indicated.
c. Do not employ automatic reset with two-wire control.
6. Bimetallic Thermal Overload Relays:
a. Provide ambient temperature compensation.
b. Interchangeable current elements/heaters.
c. Adjustable trip; plus/minus 10 percent of nominal, minimum.
d. Designed for quicker trip response under phase loss condition.
e. Trip test function.
f. Provide isolated alarm contact where indicated.
7. Melting Alloy Thermal Overload Relays:
a. Interchangeable current elements/heaters.
b. Provide isolated alarm contact where indicated.
8. Solid-State Overload Relays:
a. Selectable inverse-time trip class rating; available ratings of Class 10, 20, and 30, minimum.
b. Adjustable full load current.
c. Phase loss protection.
d. Phase imbalance protection.
e. Ground fault protection.
f. Ambient temperature insensitive.
g. Thermal memory.
h. Repeat Trip Accuracy: Plus/minus 2 percent, minimum.
i. Trip test function.

j. Provide isolated alarm contact.
k. Provide communication capability where indicated: Compatible with system indicated.

B. Fusible Devices:
1. Fusible Switches:
a. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA BS 31047, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
b. Fuse Clips: As required to accept indicated fuses.
1) Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
c. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
2. Fused Power-Circuit Devices:
a. Description: Quick-make, quick-break, dead-front bolted-pressure contact switches and high-pressure butt contact switches listed and labeled as complying with UL 977; ratings, configurations, and features as indicated on the drawings.
b. Bolted-Pressure Contact Switches: Devices with additional pressure or clamping action provided at both ends of switch blades when blades are in the fully closed position.
c. High-Pressure Butt Contact Switches: Devices with butt-type contacts and spring-charged mechanism.
d. Minimum Short Circuit Current Rating: 200,000 rms symmetrical amperes when protected by Class L fuses.
e. Fuse Clips: As required to accept Class L fuses.
f. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
g. Provide the following features and accessories where indicated or where required to complete installation:
1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating switch position.
3) Blown fuse protection and indication.

C. Circuit Breakers:
1. Interrupting Capacity (not applicable to motor circuit protectors):
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
2. Motor Circuit Protectors:
a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
b. Provide field-adjustable magnetic instantaneous trip setting.

c. Provide the following features and accessories where indicated or where required to complete installation:
   1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
   3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
   4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
   5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

3. Molded Case Circuit Breakers:
   a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
      1) Provide thermal magnetic circuit breakers unless otherwise indicated.
      2) Provide electronic trip circuit breakers where indicated.
   b. Minimum Interrupting Capacity:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
      2) Provide interchangeable trip units where indicated.
   d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      1) Provide the following field-adjustable trip response settings:
         (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         (b) Long time delay.
         (c) Short time pickup and delay.
         (d) Instantaneous pickup.
         (e) Ground fault pickup and delay where ground fault protection is indicated.
      2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
      3) Provide communication capability where indicated: Compatible with system indicated.
   e. Provide the following circuit breaker types where indicated:
      1) 100 Percent Rated Circuit Breakers: Listed for application within the motor control center where installed at 100 percent of the continuous current rating.
      2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
   f. Provide the following features and accessories where indicated or where required to complete installation:

1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

4. Insulated Case Circuit Breakers:
   a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
   b. Operation:
      1) Provide manually operated circuit breakers unless otherwise indicated.
      2) Provide electrically operated circuit breakers where indicated.
      3) Pad-Lock Provision: For preventing circuit breaker closing operation.
   c. Construction:
      1) Provide fixed-mount circuit breakers unless otherwise indicated.
      2) Provide drawout circuit breakers where indicated.
   d. Drawout Circuit Breakers:
      1) Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
      2) Provide safety interlock to prevent racking of circuit breaker while in the ON position.
      3) Pad-Lock Provision: For preventing circuit breaker drawout operation.
   e. Minimum Interrupting Capacity:
      1) 42,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 65,000 rms symmetrical amperes at 480 VAC.
   f. Trip Units: Solid state, microprocessor-based, true rms sensing.
      1) Provide the following field-adjustable trip response settings:
         (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         (b) Long time delay.
         (c) Short time pickup and delay.
         (d) Instantaneous pickup.
         (e) Ground fault pickup and delay where ground fault protection is indicated.
      2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
      3) Provide communication capability where indicated: Compatible with system indicated.
   g. Provide the following circuit breaker types where indicated:
      1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
      2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

h. Provide the following features and accessories where indicated or where required to complete installation:
   1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
   3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
   4) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
   5) Truck-Operated Cell Switch: For indicating circuit breaker racking position.

2.04 MOTOR CONTROL ACCESSORIES

A. Auxiliary Contacts:
   1. Comply with NEMA IA 10039.
   2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each starter unit, minimum.

B. Pilot Devices:
   1. Comply with NEMA IA 10039; heavy-duty type.
   2. Nominal Size: 30 mm.
   3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
   4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
   5. Indicating Lights: Push-to-test type unless otherwise indicated.
   6. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:
   1. Comply with NEMA IA 10039.
   2. Provide number and type of relays indicated or required to perform necessary functions.
   3. Timing Relays: Electronic or pneumatic as indicated.
      a. Adjustable Timing Range: As indicated on drawings.
   4. Multi-Speed Motor Starters: Employ accelerating relays, decelerating relays, and compelling relays where indicated.
   5. Accelerating Relays: Starts motor at low speed and then accelerates automatically through definite time intervals for each successive speed until selected speed is attained.
   6. Decelerating Relays: Allows motor to decelerate automatically through definite time intervals for each successive speed until selected speed is attained.
   7. Compelling Relays: Requires motor to start at low speed before a higher speed can be selected.

D. Control Power Transformers:
   1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus _____ VA spare capacity.
   2. Include primary and secondary fuses.

E. Control Terminal Blocks: Include 25 percent spare terminals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the motor control centers and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive motor control centers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install motor control centers in accordance with NECA 1 (general workmanship), NECA 402, and NEMA IA 10028.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Provide required support and attachment in accordance with Section .

E. Install motor control centers plumb and level.

F. Unless otherwise indicated, mount motor control centers on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.

G. Provide grounding and bonding in accordance with Section 260526.

H. Install all field-installed devices, components, and accessories.

I. Provide fuses complying with Section 262813 for fusible switches as indicated.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Set field-adjustable motor controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 260573.

M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

N. Provide filler plates to cover unused spaces.

O. Identify motor control centers in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Before energizing motor control center, perform insulation resistance testing in accordance with NECA 402 and NEMA IA 10028.

D. Inspect and test in accordance with NETA ATS, except Section 4.

E. Perform inspections and tests listed in NETA ATS, Section 7.16.2.1.

F. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

G. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

H. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1. Tests listed as optional are not required.

I. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

J. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

K. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

L. Test shunt trips to verify proper operation.

M. Correct deficiencies and replace damaged or defective motor control centers or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of motor control center covers and doors.

3.05 CLEANING

A. Clean dirt and debris from motor control center enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of motor controllers to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of motor control center and associated devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.07 PROTECTION

A. Protect installed motor control centers from subsequent construction operations.

END OF SECTION

SECTION 262713
ELECTRICITY METERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment for Owner electricity metering:
   1. Single circuit electricity meters.
   2. Multi-circuit electricity meters.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems: Cabinets and enclosures for metering system components.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262100 - Low-Voltage Electrical Service Entrance: Requirements for Utility Company electricity metering.

F. Section 262300 - Low-Voltage Switchgear: For interface with meters specified in this section.

G. Section 262413 - Switchboards: For interface with meters specified in this section.

H. Section 262416 - Panelboards: For interface with meters specified in this section.

I. Section 262419 - Motor-Control Centers: For interface with meters specified in this section.

J. Section 262813 - Fuses.
   1. Includes requirements for spare fuses and spare fuse cabinets.

1.03 REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2024.

B. ANSI C12.20 - American National Standard for Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes; 2022.

C. IEC 62053-21 - Electricity Metering Equipment - Particular Requirements - Part 21: Static Meters for AC Active Energy (Classes 0,5, 1 and 2); 2020.

D. IEC 62053-22 - Electricity Metering Equipment - Particular Requirements - Part 22: Static Meters for AC Active Energy (Classes 0,1S,0,2S and 0,5S); 2020.

E. IEC 62053-23 - Electricity Metering Equipment - Particular Requirements - Part 23: Static Meters for Reactive Energy (Classes 2 and 3); 2020.

F. IEEE 1459 - IEEE Standard Definitions for the Measurement of Electric Power Quantities Under Sinusoidal, Nonsinusoidal, Balanced, or Unbalanced Conditions; 2010.

G. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

I. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

J. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.
   2. Coordinate the work with other installers to provide communication lines required for electricity metering system interface.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Conduct meeting with facility representative and other related equipment manufacturers to discuss electricity metering system interface requirements.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.

C. Shop Drawings: Include system interconnection schematic diagrams showing all factory and field connections. Include requirements for interface with other systems.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field Quality Control Test Reports.

F. Project Record Documents: Record actual installed locations of meters and final equipment settings.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Enclosure Keys: Two of each different key.
   3. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Electricity Meters - Basis of Design: Veris Industries as indicated under product description below;

B. Electricity Meters - Other Acceptable Manufacturers:
   1. Veris Industries; E5x Series Enhanced Power and Energy Meter:
   2. Same as manufacturer of electrical distribution equipment used for this project.
      a. ABB/GE: www.geindustrial.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
      d. Siemens Industry, Inc: www.usa.siemens.com/#sle.

C. Substitutions: See Section 016000 - Product Requirements.

D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

E. Source Limitations: Furnish electricity meters produced by a single manufacturer and obtained from a single supplier.

2.02 EQUIPMENT FOR OWNER ELECTRICITY METERING

A. Provide microprocessor-based digital electricity metering systems including all instrument transformers, wiring, and connections necessary for measurements specified.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide electricity metering systems and associated components compatible with the equipment and associated circuits to be metered.

D. Service Conditions: Provide electricity meters suitable for operation under the service conditions at the installed location.

E. Enclosures:
   1. Where not furnished by manufacturer, provide required cabinets and enclosures in accordance with Section 260533.16.
   2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R or Type 4.
   3. Provide lockable door(s) for outdoor locations.
   4. Finish: Manufacturer's standard unless otherwise indicated.

F. Instrument Transformers:
   1. Comply with IEEE C57.13, where applicable.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.

3. Current Transformers: Compatible with connected meters; replace meters damaged by connection of incompatible current transformers. Provide shorting terminal blocks for connection of secondaries where applicable.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

G. Interface with Other Work:
1. Interface with electrical power monitoring system.
2. Interface with building automation system.

2.03 SINGLE CIRCUIT ELECTRICITY METERS

A. Single Circuit Electricity Meter - Basis of Design: Veris Industries; E5x Series Enhanced Power and Energy Meter with LCD screen interface; 5-year warranty; utilizes voltage mode CTs that do not require terminal shorting blocks; compatible with solid-core, split-core, and rope CTs.
1. Accuracy:
a. Real/Active Power/Energy: Revenue grade; plus/minus 0.2 percent, complying with ANSI C12.20 accuracy and IEC 62053-22, Class 0.2S.
b. Reactive Power/Energy: Plus/minus 2.0 percent, complying with IEC 62053-23, Class 2.
2. Measured Parameters:
a. Real/active energy (kWh); per phase and total of all phases.
b. Reactive energy (kVARh) and apparent energy (kVAh); total of all phases.
c. Net present demand over a user-specified interval (block or sliding window); real/active power (kW), reactive power (kVAR), and apparent power (kVA).
d. Maximum (peak) demand intervals; real/active power (kW), reactive power (kVAR), and apparent power (kVA).
e. Real/active power (kW), reactive power (kVAR), and apparent power (kVA); per phase and total of all phases.
f. Models Available with Bi-directional Energy Measurements:
1) Real/active energy (kWh) and apparent energy (kVAh); imported (from the grid), exported (to the grid), and signed net total.
2) Reactive energy (kVARh); imported (from the grid) and exported (to the grid), per quadrant as defined by IEEE 1459.
3) Maximum demand; real/active power (kW), reactive power (kVAR), and apparent power (kVA); imported (from the grid) and exported (to the grid).
g. Current; per phase and average of all phases.
h. Voltage; line-to-line and line-to-neutral; per phase and average of all phases.
i. Power factor; per phase and average of all phases.
j. Frequency.
3. Models Available with Data Logging: Logs and retains in non-volatile memory up to 5760 measurement records at time intervals determined by Demand Interval duration setting (up to 60 days of readings at 15 minute intervals).
4. Alarm capability, with configurable setpoints.
a. Low power factor.
b. Current over range.
c. Voltage over range.
d. Frequency out of range.
e. Models available with pulse output overrun.
5. Models Available with Pulse Contact Accumulator Input(s): Up to two; user-configurable to support measurement of other related energy values (gas, water, steam, etc.) using pulse-output transducers.
6. Outputs:

a. Models Available with Phase Loss Alarm Output: One; user-configurable phase loss threshold.
b. Models Available with Pulse Output(s): Up to two.

7. Communications: Compatible with connected systems. Provide all accessories necessary for proper interface.
   a. Models available with Serial Communications:
      1) RS-485, 2-wire; support for Modbus RTU protocol.
      2) RS-485, 2-wire; support for BACnet MS/TP protocol.
      3) LON FT, 2-wire; support for LonTalk protocol.

2.04 MULTI-CIRCUIT ELECTRICITY METERS

A. Multi-Circuit Electricity Meter - Basis of Design: Veris Industries; E3x Series Panelboard Monitoring System; 5-year warranty; utilizes voltage mode CTs that do not require shorting terminal blocks.
   1. Metering Capacity: As indicated or as required for circuits to be monitored (configurations available for monitoring up to 84 branch circuits, two 3-phase main devices, and two neutrals with one meter).
   2. Accuracy:
      a. Real/Active Power/Energy (for models that measure this parameter): Revenue grade; plus/minus 1.0 percent (including branch CTs); complying with ANSI C12.1 and IEC 62053-21, Class 1.
      b. Voltage (for models that measure this parameter): Plus/minus 0.5 percent.
      c. Current: Plus/minus 0.5 percent.
   3. Measured Parameters at Main Device:
      a. Current; per phase and average of all phases.
      b. Maximum current; per phase and maximum average of all phases.
      c. Current demand; per phase and average of all phases.
      d. Maximum current demand; per phase and maximum average of all phases.
      e. Models available with measurements for:
         1) Current phase angle.
         2) Real/active energy (kWh); per phase and total of all phases.
         3) Snapshot of total energy as of the completion of the most recent demand interval; per phase and total of all phases.
         4) Real/active power (kW); per phase and total of all phases; available signed to indicate whether energy is being imported or exported.
         5) Apparent power (kVA); per phase and total of all phases.
         6) Power factor; per phase and total, based on three-phase breaker rotation, signed, to indicate leading or lagging current.
         7) Voltage, line-to-line and line-to neutral; per phase and average of all phases.
         8) Voltage phase angle.
         9) Frequency; phase A.
   4. Measured Parameters at Branch Circuits:
      a. Current; per branch and average of all phases for multi-phase logical circuits.
      b. Maximum current; per branch and maximum average of all phases for multi-phase logical circuits.
      c. Current demand; per branch and average of all phases for multi-phase logical circuits.
      d. Maximum current demand; per branch and maximum average of all phases for multi-phase logical circuits.
      e. Models available with measurements for:
         1) Current phase angle.

2) Real/active power (kW); per branch and total of all phases for multi-phase logical circuits; available signed to indicate whether energy is being imported or exported.
3) Real/active power (kW) demand; per branch and total of all phases for multi-phase logical circuits.
4) Real/active power (kW) demand maximum; per branch and total of all phases for multi-phase logical circuits.
5) Real/active energy (kWh); per branch and total of all phases for multi-phase logical circuits.
6) Snapshot of total energy as of the completion of the most recent demand interval; per branch and total of all phases for multi-phase logical circuits.
7) Apparent power (kVA); per branch and total of all phases for multi-phase logical circuits.
8) Power factor; per branch and average of all phases for multi-phase logical circuits, signed to indicate leading or lagging current.

5. Alarm capability, with configurable setpoints.
   a. Current over/under range.
   b. Models available with voltage over/under range.
6. Communications: Compatible with connected systems. Provide all accessories necessary for proper interface.
   a. Models Available with Serial Communications:
      1) RS-485, 2-wire or 4-wire; support for Modbus RTU protocol.
      2) RS-485, 2-wire; support for Modbus RTU and BACnet MS/TP protocols.
   b. Models Available with Ethernet Communications:
      1) Without RJ-45 10/100 Mbit; requires Modbus TCP Gateway; support for Modbus TCP protocol.
      2) With RJ-45 10/100 Mbit; support for Modbus TCP, BACnet IP, and SNMP protocols.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the ratings and configurations of metering systems and associated components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive meters.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Provide required support and attachment components in accordance with Section 260529.
D. Provide grounding and bonding in accordance with Section 260526.
E. Provide fuses complying with Section 262813 as required.
F. Identify meters and associated wiring in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

D. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

E. Correct deficiencies and replace damaged or defective metering system components.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING

A. Program system parameters according to requirements of Owner.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.07 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.
B. Wall dimmers.
C. Fan speed controllers.
D. Receptacles.
E. Wall plates.
F. Floor box service fittings.
G. Poke-through assemblies.
H. Access floor boxes.

1.02 RELATED REQUIREMENTS

A. Section 096900 - Access Flooring.
B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
C. Section 260526 - Grounding and Bonding for Electrical Systems.
D. Section 260533.16 - Boxes for Electrical Systems.
E. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.
F. Section 260539 - Underfloor Raceways for Electrical Systems.
G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
H. Section 260583 - Wiring Connections: Cords and plugs for equipment.
I. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.
J. Section 271000 - Structured Cabling: Voice and data jacks.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).
B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).
C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
   6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Wall Dimmers: Include derating information for ganged multiple devices.
   2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

C. Samples: One for each type and color of device and wall plate specified.

D. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data:
   1. Wall Dimmers: Include information on operation and setting of presets.
   2. GFCI Receptacles: Include information on status indicators.
   3. Surge Protection Receptacles: Include information on status indicators.

H. Project Record Documents: Record actual installed locations of wiring devices.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
   3. Extra Keys for Locking Switches: Two of each type.

4. Extra Surge Protection Receptacles: Two of each type.
5. Extra Wall Plates: One of each style, size, and finish.
6. Extra Flush Floor Service Fittings: Two of each type.
7. Extra Poke-Through Core Hole Closure Plugs: Two for each core size.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
D. Products: Listed, classified, and labeled as suitable for the purpose intended.
E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
D. Provide tamper resistant receptacles for receptacles installed in dwelling units.
E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
F. Provide GFCI protection for receptacles installed in kitchens.
G. Provide GFCI protection for receptacles serving electric drinking fountains.
H. Provide isolated ground receptacles for receptacles serving computers and electronic cash registers.
I. Unless noted otherwise, do not use combination switch/receptacle devices.
J. For flush floor service fittings, use tile rings for installations in tile floors.
K. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.
B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.
D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

F. Wiring Devices Installed _____: White with white nylon wall plate.

G. Isolated Ground Convenience Receptacles: Orange.

H. Surge Protection Receptacles: Blue.

I. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.

J. Above-Floor Service Fittings: Gray wiring devices with satin aluminum housing.

K. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.

L. Flush Poke-Through Service Fittings: Gray wiring devices with aluminum cover and aluminum flange.

M. Access Floor Boxes: Gray wiring devices with gray steel cover with insert to match floor covering.

2.03 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20and where applicable FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

E. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

F. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

G. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

H. Locking Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed three position switch actuator and momentary contacts; switches keyed alike; single pole double throw, off with switch actuator in center position.

2.04 WALL DIMMERS

A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

B. Control: Slide control type with separate on/off switch.

2.05 RECEPTACLES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
5. Substitutions: See Section 016000 - Product Requirements.
6. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
3. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
4. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
5. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
6. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
7. Illuminated Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R; illuminated face or indicator light to indicate power is being supplied to receptacle; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
   5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.
   4. Provide screwless wallplates with concealed mounting hardware where indicated.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Brass Wall Plates: Brushed satin finish, factory-coated to inhibit oxidation.

F. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.

G. Chrome Wall Plates: Smooth finish, chrome plated steel.

H. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

I. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.

J. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

K. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.07 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Thomas & Betts Corporation: www.tnb.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.

C. Above-Floor Service Fittings:
   1. Single Service Pedestal Convenience Receptacles:

a. Configuration: One standard convenience duplex receptacle.
2. Single Service Pedestal Communications Outlets:
a. Configuration: One 1 inch bushed opening.
b. Voice and Data Jacks: As specified in Section 271000.
3. Single Service Pedestal Furniture Feed:
a. Configuration: One 3/4 inch knockout.
4. Dual Service Pedestal Combination Outlets:
a. Configuration:
1) Power: One standard convenience duplex receptacle.
2) Communications: One 1 inch bushed opening.
3) Voice and Data Jacks: As specified in Section 271000.
b. Provide barrier to separate line and low voltage compartments.

D. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
a. Cover: Rectangular.
b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
2. Single Service Flush Communications Outlets:
a. Cover: Rectangular.
b. Configuration: _____.
c. Voice and Data Jacks: As specified in Section 271000.
3. Single Service Flush Furniture Feed:
a. Cover: Rectangular.
b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
4. Dual Service Flush Combination Outlets:
a. Cover: Rectangular.
b. Configuration:
1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
2) Communications:
3) Voice and Data Jacks: As specified in Section 271000.
4) Voice and Data Jacks: Provided by others.
5. Dual Service Flush Furniture Feed:
a. Cover: Rectangular.
b. Configuration:
1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).
6. Accessories:
a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.
7. Products:
a. Hubbell Incorporated: www.hubbell.com/#sle.

2.08 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Thomas & Betts Corporation: www.tnb.com/#sle.
3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Above-Floor Service Fittings:
   1. Single Service Pedestal Convenience Receptacles:
      a. Configuration: One standard convenience duplex receptacle.
   2. Single Service Pedestal Communications Outlets:
      a. Configuration: One 1 inch bushed opening.
      b. Voice and Data Jacks: As specified in Section 271000.
   3. Single Service Pedestal Furniture Feed:
      a. Configuration: One 3/4 inch knockout.
   4. Dual Service Pedestal Combination Outlets:
      a. Configuration:
         1) Power: One standard convenience duplex receptacle.
         2) Communications: One 1 inch bushed opening.
         3) Voice and Data Jacks: As specified in Section 271000.
      b. Provide barrier to separate line and low voltage compartments.
   5. Products:
      a. Hubbell Incorporated: www.hubbell.com/#sle.
      b. Substitutions:

D. Flush Floor Service Fittings:
   1. Single Service Flush Convenience Receptacles:
      a. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
   2. Single Service Flush Communications Outlets:
      a. Configuration: _____.
      b. Voice and Data Jacks: As specified in Section 271000.
   3. Single Service Flush Furniture Feed:
      a. Configuration: One 2 inch by 1-1/4 inch combination threaded opening(s).
   4. Dual Service Flush Combination Outlets:
      a. Cover: Hinged door(s).
      b. Configuration:
         1) Power: One standard convenience duplex receptacle(s).
         2) Communications:
         3) Voice and Data Jacks: As specified in Section 271000.
   5. Dual Service Flush Furniture Feed:
      a. Configuration:
         1) Power: One 3/4 inch threaded opening(s).
         2) Communications: Two 1/2 inch threaded opening(s).
   6. Accessories:
      a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

2.09 ACCESS FLOOR BOXES

A. Manufacturers - Access Floor Boxes:
   1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
   2. Thomas & Betts Corporation: www.tnb.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.

4. Substitutions: See Section 016000 - Product Requirements.

B. Manufacturers - Access Floor Boxes with Pre-wired Connectors for Manufactured Wiring Systems:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: www.relocwiring.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.
   5. Source Limitations: Provide access floor boxes with pre-wired connectors produced by the same manufacturer as the manufactured wiring system used for this project.

C. Description: Metallic multi-service box suitable for mounting in access floor system specified in Section 096900.

D. Access floor boxes with pre-wired connectors for manufactured wiring systems are permitted only where manufactured wiring systems are permitted as specified in Section 260519.

E. Configuration:
   1. Power: Two standard convenience duplex receptacle(s).
   2. Communications:
   3. Voice and Data Jacks: Provided by others.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that openings in access floor are in proper locations.

I. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Wall Dimmers: 48 inches above finished floor.

c. Receptacles: 18 inches above finished floor or 6 inches above counter.

2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

J. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

K. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

L. Install wiring devices plumb and level with mounting yoke held rigidly in place.

M. Install wall switches with OFF position down.

N. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

O. Do not share neutral conductor on branch circuits utilizing wall dimmers.

P. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

Q. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

R. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

S. Identify wiring devices in accordance with Section 260553.

T. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.
B. Inspect each wiring device for damage and defects.
C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
D. Test each receptacle to verify operation and proper polarity.
E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
F. Inspect each surge protection receptacle to verify surge protection is active.
G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.
B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 262813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.02 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 262413 - Switchboards: Fusible switches.

C. Section 262416 - Panelboards: Fusible switches.

D. Section 262419 - Motor-Control Centers: Fusible switches.

E. Section 262513 - Low-Voltage Busways: Fusible switches.

F. Section 262816.16 - Enclosed Switches: Fusible switches.

G. Section 262913 - Enclosed Controllers: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
    a. Fusible Switches for Switchboards: See Section 262413.
    b. Fusible Switches for Panelboards: See Section 262416.
    c. Fusible Switches for Motor Control Centers: See Section 262419.
    d. Fusible Switches for Busway: See Section 262501.
    e. Fusible Enclosed Switches: See Section 262816.16.

f. Fusible Switches for Enclosed Motor Controllers: See Section 262913.

2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
   1. Spare Fuse Cabinet: Include dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.
   4. Spare Fuse Cabinet Keys: Two.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Littelfuse, Inc: www.littelfuse.com/#sle.

C. Mersen: ep-us.mersen.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

C. General Purpose Branch Circuits: Class RK1, time-delay.

D. Individual Motor Branch Circuits: Class RK1, time-delay.

E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

F. Primary Protection for Control Transformers: Class CC, time-delay.

2.03 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.
B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
C. Provide fuses of the same type, rating, and manufacturer within the same switch.
D. Comply with UL 248-1.
E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
F. Voltage Rating: Suitable for circuit voltage.
G. Class R Fuses: Comply with UL 248-12.
H. Class L Fuses: Comply with UL 248-10.
I. Class CC Fuses: Comply with UL 248-4.

2.04 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.
B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
B. Verify that mounting surfaces are ready to receive spare fuse cabinet.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.
B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
C. Install spare fuse cabinet where indicated.
D. Identify spare fuse cabinet in accordance with Section 260553.

END OF SECTION

SECTION 262816.13
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.
B. Section 260529 - Hangers and Supports for Electrical Systems.
C. Section .
   1. Includes requirements for the seismic qualification of equipment specified in this section.
D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
J. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
K. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of circuit breaker upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings upon request.
   5. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.
B. Eaton Corporation: www.eaton.com/#sle.
C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
D. Siemens Industry, Inc: www.usa.siemens.com/#sle.
E. Substitutions: See Section 016000 - Product Requirements.
F. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Seismic Qualification: Provide enclosed circuit breakers and associated components suitable for application under the seismic design criteria specified in Section where required. Include certification of compliance with submittals.
D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
    1. Altitude: Less than 6,600 feet.
    2. Ambient Temperature: Between 23 degrees F and 104 degrees F.
E. Short Circuit Current Rating:
    1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.
    2. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
    3. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
    4. Label equipment utilizing series ratings as required by NFPA 70.
F. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
G. Conductor Terminations: Suitable for use with the conductors to be installed.
H. Provide thermal magnetic circuit breakers unless otherwise indicated.
I. Provide electronic trip circuit breakers where indicated.
J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
K. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

L. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
   3. Provide surface-mounted enclosures unless otherwise indicated.

M. Provide externally operable handle with means for locking in the OFF position.

N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
      c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

O. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      b. 14,000 rms symmetrical amperes at 480 VAC.
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Provide compression lugs unless otherwise indicated.
   2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   2. Provide interchangeable trip units where indicated.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   1. Provide the following field-adjustable trip response settings:

a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
b. Long time delay.
c. Short time pickup and delay.
d. Instantaneous pickup.
e. Ground fault pickup and delay where ground fault protection is indicated.

2. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
3. Provide communication capability where indicated: Compatible with system indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

G. Provide the following circuit breaker types where indicated:
1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
3. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

H. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.

I. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.

J. Provide the following features and accessories where indicated or where required to complete installation:
1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
3. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
4. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section .
E. Provide required seismic controls in accordance with Section .
F. Install enclosed circuit breakers plumb.
G. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.
H. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
I. Provide grounding and bonding in accordance with Section 260526.
J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
K. Set field-adjustable circuit breaker tripping function settings as indicated.
L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
M. Identify enclosed circuit breakers in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.
B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than _____ amperes. Tests listed as optional are not required.
D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
    1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
E. Test GFCI circuit breakers to verify proper operation.
F. Test shunt trips to verify proper operation.
G. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.
B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.
B. Section 260529 - Hangers and Supports for Electrical Systems.
C. Section .
D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 262813 - Fuses.
F. Section 262913 - Enclosed Controllers: Manual motor controllers.
G. Section 263600 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Project Record Documents: Record actual locations of enclosed switches.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. General Electric Company: www.geindustrial.com/#sle.

B. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

F. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section where required. Include certification of compliance with submittals.

D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

E. Horsepower Rating: Suitable for connected load.

F. Voltage Rating: Suitable for circuit voltage.

G. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Minimum Ratings:
      a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
      b. General Duty Single Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
      c. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
      d. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

H. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

I. Provide with switch blade contact position that is visible when the cover is open.

J. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

K. Conductor Terminations: Suitable for use with the conductors to be installed.

L. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

M. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

N. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

O. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

P. Heavy Duty Switches:
   1. Comply with NEMA BS 31047.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Provide compression lugs where indicated.
      c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
      a. Provide means for locking handle in the ON position where indicated.

Q. General Duty Switches:
   1. Conductor Terminations:
      a. Provide mechanical lugs.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Provide externally operable handle with means for locking in the OFF position, capable of accepting two padlocks.

R. Provide the following features and accessories where indicated or where required to complete installation:
   1. Hubs: As required for environment type; sized to accept conduits to be installed.
   2. Integral fuse pullers.
   3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
   4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.
   5. Interlocked Receptacle: Integral pre-wired three phase, three wire, grounded type receptacle interlocked with switch mechanism to prevent insertion or removal of plug with switch in the ON position and to prevent switch from being placed in the ON position without matching plug inserted. Provide receptacle configuration as required to accept plug as indicated on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section .

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Identify enclosed switches in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262923
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable frequency controllers.

1.02 RELATED REQUIREMENTS

A. Section .

B. Section .
   1. Includes requirements for the seismic qualification of equipment specified in this section.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

A. NEMA IS 10034 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems; 2022 (Reapproved 2025).

B. NEMA IS 10033 - Adjustable Speed Drives; 2020 (Reapproved 2025).

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
   1. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Test Reports: Indicate field test and inspection procedures and test results.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Manufacturer's Field Reports: Indicate start-up inspection findings.

H. Operation Data: NEMA IS 10034. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

I. Maintenance Data: NEMA IS 10034. Include routine preventive maintenance schedule.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Air Filters: Two of each type.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Variable Frequency Motor Controllers:
   1. ABB/GE: www.geindustrial.com/#sle.
   2. Danfoss: www.danfoss.com/#sle.
   3. Eaton Corporation: www.eaton.com/#sle.
   4. Rockwell Automation, Inc.; Allen-Bradley Products: ab.rockwellautomation.com/#sle.
   5. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
   6. Siemens Industry, Inc: www.usa.siemens.com/#sle.

B. Substitutions: See Section 016000 - Product Requirements.

C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

D. Source Limitations: Furnish variable frequency motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

2.02 DESCRIPTION

A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA IS 10033. Select unspecified features and options in accordance with NEMA ICS 3.1.
   1. Employ microprocessor-based inverter logic isolated from power circuits.
   2. Employ pulse-width-modulated inverter system.
   3. Design for ability to operate controller with motor disconnected from output.
   4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

B. Seismic Qualification: Provide variable frequency controllers and associated components suitable for application under the seismic design criteria specified in Section where required. Include certification of compliance with submittals.

C. Enclosures: NEMA EN 10250, Type 1, suitable for equipment application in places regularly open to the public.

D. Finish: Manufacturer's standard enamel.

2.03 OPERATING REQUIREMENTS

A. Rated Input Voltage: 208 volts, three phase, 60 Hertz.

B. Motor Nameplate Voltage: 200 volts, three phase, 60 Hertz.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0 degrees C to 40 degrees C.

E. Volts Per Hertz Adjustment: Plus or minus 10 percent.

F. Current Limit Adjustment: 60 to 110 percent of rated.

G. Acceleration Rate Adjustment: 0.5 to 30 seconds.

H. Deceleration Rate Adjustment: 1 to 30 seconds.

I. Input Signal: 4 to 20 mA DC.

2.04 COMPONENTS

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.

C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control.

D. Include undervoltage release.

E. Control Power Source: Separate circuit.

F. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

G. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

H. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

I. Manual Bypass: Furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. Include isolation switch to allow maintenance of inverter during bypass operation.

J. Emergency Stop: Use dynamic brakes for emergency stop function.

K. Disconnecting Means: Include integral fused disconnect switch on the line side of each controller.

L. Wiring Terminations: Match conductor materials and sizes indicated.

2.05 SOURCE QUALITY CONTROL

A. Shop inspect and perform standard productions tests for each controller.

B. Make completed controller available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.

C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner at least 7 days before inspections and tests are scheduled.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

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

3.02 INSTALLATION

A. Install in accordance with NEMA IS 10034 and manufacturer's instructions.

B. Provide required support and attachment in accordance with Section .

C. Provide required seismic controls in accordance with Section .

D. Tighten accessible connections and mechanical fasteners after placing controller.

E. Provide fuses in fusible switches; refer to Section 262813 for product requirements.

F. Select and install overload heater elements in motor controllers to match installed motor characteristics.

G. Identify variable frequency controllers in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Provide the service of the manufacturer's field representative to prepare and start controllers.

B. Perform field inspection and testing in accordance with Section 014000.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.17. The insulation-resistance test on control wiring listed as optional is not required.

3.04 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of controllers in automatic and manual modes.

3.06 MAINTENANCE

A. See Section 017000 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

C. Provide service and maintenance of controllers for one year from Date of Substantial Completion.

END OF SECTION

SECTION 263100
PHOTOVOLTAIC COLLECTORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Photovoltaic system requirements.
B. Photovoltaic modules.
C. Photovoltaic module mounting system.
D. Photovoltaic combiner boxes.
E. Photovoltaic inverters.
F. Monitoring system.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
B. Section 260526 - Grounding and Bonding for Electrical Systems.
C. Section 260529 - Hangers and Supports for Electrical Systems.
D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 262100 - Low-Voltage Electrical Service Entrance.
F. Section 262200 - Low-Voltage Transformers: Isolation transformers not integral to inverters.
G. Section 262813 - Fuses.
H. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. IEC 61215-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1: Test Requirements; 2021, with Corrigendum.
B. IEC 61215-1-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-1: Special Requirements for Testing of Crystalline Silicon Photovoltaic (PV) Modules; 2021.
C. IEC 61215-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 2: Test Procedures; 2021.
D. IEEE 1547 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces; 2018, with Amendment (2020).
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
F. NECA 412 - Standard for Installing and Maintaining Photovoltaic (PV) Power Systems; 2012.
G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.
J. UL 1699B - Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection; Current Edition; Current Edition, Including All Revisions.

K. UL 1703 - Flat Plate Photovoltaic Modules and Panels; Current Edition, Including All Revisions.

L. UL 1741 - Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for photovoltaic system components.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Include adequate instruction on the electrical hazards associated with photovoltaic systems and appropriate safety procedures to be followed.

C. Rebates and Incentives: Prepare and submit documentation as required for Owner to secure funds from available federal, state, and utility company rebate and incentive programs. Notify Owner of any time constraints affecting program qualification.

D. Utility Interconnection:
   1. See Section 262100 for Utility Company contact information and additional requirements.
   2. Prepare and submit documentation as required for securing utility interconnection agreement between Owner and Utility Company.
   3. Preinstallation Meeting: Convene one week prior to commencing work of this section to review interconnection requirements and details with Utility Company representative.
   4. Coordinate with Utility Company to provide utility metering suitable for system requirements.
   5. Arrange for inspections and secure permits necessary to obtain Utility Company approval of system.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, attachment locations and details, and proposed size, type, and routing of conduits and cables. Include system interconnection schematic diagrams showing all factory and field connections.

D. Design Data:
   1. Include structural calculations, certified by structural engineer, for equipment and mounting system.
   2. Include electrical calculations for array and associated equipment other than the basis of design products and configuration.

E. Certify that products of this section meet or exceed specified requirements.

F. Installer's Qualifications: Include evidence of compliance with specified requirements.

G. Certify that work of this section does not void roof warranty.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

I. Manufacturer’s detailed field testing procedures.

J. Manufacturer's detailed startup procedures.

K. Field quality control test reports.
   1. Include manufacturer's field reports.

L. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

M. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

N. Maintenance contracts.

O. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

P. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Photovoltaic Modules: Two.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with Utility Company requirements for interconnection.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with photovoltaic systems of similar size, type, and complexity.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Specified warranties indicate minimum requirements. Provide additional warranties or extended warranty periods where required to qualify for rebate and incentive programs.

C. Photovoltaic Modules:
   1. Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
   2. Provide manufacturer warranty guaranteeing minimum 90 percent of rated power output for 10 years and minimum 80 percent of rated power output for 20 years.

D. Photovoltaic Module Mounting System: Provide minimum 10 year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

E. Photovoltaic Combiner Boxes: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

F. Photovoltaic Inverters: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

G. Charge Controllers: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Photovoltaic Modules - Basis of Design: As indicated on Drawings.

2.02 PHOTOVOLTAIC SYSTEM REQUIREMENTS

A. Provide complete photovoltaic system consisting of photovoltaic modules and associated balance of system components necessary for connection to facility electrical system.

B. System Description:
   1. Photovoltaic array is mounted in location indicated on the drawings.
   2. Orientation of array is as indicated on the drawings.
   3. Photovoltaic DC system is negative grounded.
   4. System includes interconnection with utility grid (grid-tied system).
      a. Utility metering configuration: Net metering.
   5. System does not include battery storage system.
   6. System does not include engine generator.
   7. System includes DC system surge protection.
   8. System includes monitoring system.

C. Capacity:
   1. Total Nominal Rated Power Output of Array: Equal to or greater than the rated output of the basis of design array.

D. Size:
   1. Array: Designed to fit within the area designated on the drawings.
   2. Individual Modules: Size is not critical.

E. Appearance:
   1. Only systems with similar appearance to basis of design system will be considered.
   2. Arrange array such that modules are aligned with uniform spacing.
   3. Make no alterations affecting appearance of building exterior or interior without approval of Architect.
   4. Final determination of acceptable appearance is by Architect.

F. Fire Resistance Rating: Provide photovoltaic module and mounting system combination that together with the roof covering form a system listed in accordance with UL 1703 to provide a fire rating equal to or better than the required fire rating of the roof.

G. Provide photovoltaic system and associated components suitable for wind loads, snow loads, seismic loads, and other structural design considerations of the installed location.

H. Provide photovoltaic system and associated components suitable for continuous operation under the service conditions at the installed location.

I. Provide products listed, classified, and labeled as suitable for the purpose intended.

J. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system.

K. DC Arc Fault Circuit Protection: Provide DC photovoltaic arc-fault protection devices listed as complying with UL 1699B as required for compliance with NFPA 70.

L. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

M. Arrange array to minimize shading during peak production periods.

2.03 PHOTOVOLTAIC MODULES

A. Acceptable Module Types: Only crystalline silicon modules are acceptable. Thin film modules will not be considered for this project.

B. General Requirements:
   1. Photovoltaic Modules: Factory assembled; consisting of photovoltaic cells, frame, junction box, cables for series connection, and bypass diodes for shade tolerance; rated for 600 V DC; complying with IEC 61215-1 and IEC 61215-2 and listed as complying with UL 1703.
   2. Crystalline Silicon Photovoltaic Modules: Comply with IEC 61215-1-1.
   3. Frame: Anodized aluminum.
   4. Factory-Installed Junction Box: Weatherproof, with factory-installed terminals and bypass diodes.
   5. Factory-Installed Cables: Type USE-2 or listed photovoltaic (PV) wire with polarized locking connectors.
   6. Unless otherwise indicated, specified module performance characteristics are rated under Standard Test Conditions (STC).

2.04 BALANCE OF SYSTEM COMPONENTS

A. Photovoltaic Module Mounting System:
   1. Provide complete mounting system compatible with modules to be installed and suitable to properly install them in the location indicated, including all necessary hardware and accessories.
   2. Support Structure and Associated Hardware Materials: Use aluminum, galvanized steel, or stainless steel.
   3. Roof-Mounted Arrays:
      a. Acceptable System Types: Either non-penetrating or penetrating systems complying with specified requirements will be considered for this project.
      b. Provide system compatible with the roof at the installed location.
      c. Module Tilt Angle: As required to provide maximum energy production for installed location.
      d. Provide minimum clearance of 3 inches between roof and module for air circulation and drainage.

B. Photovoltaic Combiner Boxes:
   1. Provide combiner box(es) for termination of strings as indicated or as required for the array configuration installed.
   2. Combiner Boxes: Rated for 600 V DC; current ratings suitable for connected strings; equipped with fuseholders; listed as complying with UL 1741.
   3. Fuseholders: Touch-safe; suitable to accept fuses indicated.
   4. Number of Input Circuits: As indicated or as required for termination of strings, with minimum of 25 percent spare capacity for future expansion.
   5. Enclosure: NEMA EN 10250, Type 3R, unless otherwise indicated.
   6. Provide integral load-break rated disconnect.

7. Provide with capability of current monitoring for individual strings.

C. Photovoltaic Inverters:
1. Provide inverter(s) as indicated or as required for connection of the photovoltaic array DC system to the AC system indicated.
2. Inverters: Suitable for the requirements of the connected array; output configuration compatible with connected system; listed as complying with UL 1741; furnished with the following features:
a. Maximum power point tracking (MPPT).
b. LCD display.
c. Integral AC disconnect.
d. Integral DC disconnect.
e. Integral DC ground fault detection and interruption (GFDI).
f. Communications Interface: As required for connection to system indicated.
3. Grid-Tied Inverters: Comply with IEEE 1547, including over/under grid voltage and frequency protection, and anti-islanding protection to automatically disconnect upon loss of utility power and to remain disconnected until utility power restoration has been maintained for five minutes.
4. Grounded Photovoltaic DC Systems: Furnish with integral isolation transformer. Transformerless inverters may be used if a separate isolation transformer is provided.
5. Total Harmonic Distortion: Less than five percent.
6. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

D. Surge Protective Devices, in Addition to Requirements of Section 264300:
1. Surge Protective Devices for DC System:
a. Rated for 600 V DC.
b. Listed and labeled as complying with UL 1449, Type 1.
c. Surge Current Rating: Not less than 50 kA per mode.
d. UL 1449 Nominal Discharge Current (I-n): 20 kA.

E. Monitoring System:
1. Provide a system to monitor photovoltaic system performance including all sensors, dataloggers, connections, software, equipment and accessories necessary for a complete operating system.
2. System communications interfaces to be wired or wireless, with compatible interconnected components.
a. Provide suitable raceway, minimum 3/4 inch trade size, for all required wired connections.
3. System to monitor and record, in 15 minute intervals:
a. Inverter status.
b. Instantaneous power (kW).
c. Cumulative energy production (kWh).
4. System real-time and historical data to be accessible from the following locations:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Use open circuiting, short circuiting, or opaque covering to disable modules, array or portions of array prior to installation and service.

B. Roof-Mounted Arrays: Protect roof and adjacent roof-mounted items from damage.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment in accordance with Section .

D. Mount equipment such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor, ground, or working platform.

E. Circuiting Requirements. in Addition to Requirements of Section 260519:
   1. Photovoltaic DC System Conductor Color Code:
      a. Negative Grounded System:
         1) Positive: Red.
         2) Negative/Grounded: White.
   2. Maintain separation of photovoltaic and non-photovoltaic circuits in accordance with NFPA 70.

F. Grounding and Bonding Requirements, in Addition to Requirements of Section 260526:
   1. Ensure that there is only one AC System bonding connection between grounding system and grounded/neutral conductor, including external connections and connections internal to equipment.
   2. Grounded DC Systems: Ensure that there is only one point of system grounding connection to the grounded conductor, including external connections and connections internal to equipment.

G. Identification Requirements, in Addition to Those Specified in Section 260553:
   1. Use identification nameplate or means of identification acceptable to authority having jurisdiction to identify the presence of multiple power sources and the location of main service disconnecting means and each photovoltaic system disconnecting means. Locate at main service disconnecting means and at each photovoltaic system disconnecting means. Verify format and descriptions with authorities having jurisdiction.
   2. Use identification nameplate to identify each photovoltaic system disconnecting means with text "PV SYSTEM DISCONNECT".
   3. Use identification nameplate or identification label to identify systems equipped with rapid shutdown and associated rapid shutdown switch(es). Format, descriptions, and locations to comply with NFPA 70 and requirements of authorities having jurisdiction.
   4. Use identification nameplate or identification label to identify the information required by NFPA 70 for marking of direct-current photovoltaic power sources. Locate at each DC disconnect means requiring marking.
   5. Use identification nameplate or identification label to identify the interactive system point of interconnection at the disconnecting means as a power source and with the rated AC output current and the nominal operating AC voltage.
   6. Use warning labels to identify electrical hazards for photovoltaic system disconnecting means. Include the word message "Warning - Electric Shock Hazard; Terminals on the line and load sides may be energized in the open position" or approved equivalent.
   7. Use wire and cable markers to identify photovoltaic system source, output, and inverter circuit conductors at all points of termination, connection, and splices.

8. Use voltage markers, identification labels, stenciled text, or suitable permanent marking approved by authority having jurisdiction to identify exposed raceways, cable trays, pull boxes, junction boxes, and conduit bodies with the text "Warning: Photovoltaic Power Source" at maximum intervals of 10 feet in accordance with NFPA 70.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. See article "SYSTEM STARTUP" below for additional requirements related to testing and inspection.

C. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

D. Inspection and testing to include, at a minimum:
   1. Inspect each system component for damage and defects.
   2. Verify that equipment enclosures, boxes, and associated connections installed outdoors are weatherproof.
   3. Verify proper wiring connections have been made and check for conductor continuity. Verify proper polarity.
   4. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
   5. Measure and record voltages at the inverter AC and DC inputs.
   6. Measure and record AC output power.
   7. Perform inverter functional test.
      a. Grid-Tied Inverters: Include simulation of loss of utility power and subsequent power restoration.
   8. Verify proper operation of monitoring system.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.05 SYSTEM STARTUP

A. Provide services of a manufacturer's authorized representative to assist in performing system startup. Include manufacturer's detailed startup procedures with submittals.

B. Obtain Owner's approval prior to performing system startup.

C. Grid-Tied Systems: Obtain Utility Company's approval prior to performing system startup.

D. Prepare and start system in accordance with manufacturer's instructions.

3.06 CLEANING

A. Clean modules using only methods recommended by manufacturer to avoid scratches and other damage. Clean exposed surfaces on other components to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of photovoltaic system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.

3.08 PROTECTION

A. Protect installed products from subsequent construction operations.

3.09 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of photovoltaic system for two years from date of Substantial Completion, to include the work described below; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

C. Conduct site visit at least once every six months to perform inspection, testing, and preventive maintenance. Conduct tests similar to those made during original field quality control testing. Submit report to Owner comparing test results with those of original tests along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by Owner:
   1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 263323
CENTRAL BATTERY EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Emergency power supply.
B. Uninterruptible power supply (UPS) centralized emergency lighting inverters.
C. Remote trouble alarm indicator.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
B. Section 260529 - Hangers and Supports for Electrical Systems.
C. Section 265100 - Interior Lighting:
D. Section 265600 - Exterior Lighting: Luminaires for interface with centralized emergency lighting inverters.

1.03 REFERENCE STANDARDS

A. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

1.04 EMERGENCY POWER SUPPLY

A. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 RATINGS

A. NFPA 111 - Standard on Stored Electrical Energy Emergency and Standby Power Systems; 2025.
B. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
C. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Inverter Output Frequency: Hz plus percent.
B. Coordination:
C. Efficiency: 90 percent minimum.
D. Maximum Recharge Time: hours following hour discharge.
E. Total Harmonic Distortion: Less than percent at full resistive load.
F. Battery: Nickel cadmium, sealed type battery.
G. Accessories:
H. Instrumentation and Alarms: NFPA 111.

I. Charger: Dual rate, designed to maintain battery in full-charge condition during normal conditions.

J. Coordination:
   1. Coordinate compatibility of centralized emergency lighting inverters to be installed with work provided under other sections or by others.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   3. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings: Indicate dimensions, input/output voltages, power ratings, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, and installed features and accessories.

D. Specimen Warranty: Submit sample of manufacturer's warranty.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

G. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

H. Maintenance contracts.

I. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Enclosure Keys: Two of each different key.
   3. Battery Fuses: See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.08 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 101 (Life Safety Code).
   3. NFPA 111; meet requirements for Level 1 system.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with centralized emergency lighting inverter systems of similar size, type, and complexity; manufacturer's authorized installer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to inverter system components, enclosure, and finish.

D. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

1.10 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.11 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Inverter Assemblies: Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

C. Batteries: Provide pro-rata warranty for the duration of rated design life.

PART 2 PRODUCTS

2.01 CENTRALIZED EMERGENCY LIGHTING INVERTERS - GENERAL REQUIREMENTS

A. Provide complete centralized emergency lighting inverter system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Inverter Assemblies: Manufactured units consisting of inverters, batteries, enclosures, and associated components specifically designed for emergency lighting applications; microprocessor-based utilizing pulse width modulation (PWM) with insulated gate bipolar transistors (IGBT's); listed and labeled as complying with UL 924.
   1. Battery Run Times of 90 Minutes: Listed as complying with UL 924 for "emergency lighting and power equipment".
   2. Battery Run Times Other than 90 Minutes: Listed as complying with UL 924 for "auxiliary lighting and power equipment".

D. Provide inverters and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Increase indicated power ratings as required to accommodate any applicable inverter load restrictions.

F. Inverters Installed in Spaces Used for Environmental Air: Plenum rated; listed and labeled as complying with UL 2043, suitable for use in air-handling spaces.

G. Battery System:
   1. Provide battery capacity as required for achieving battery run time indicated.
   2. Battery Charger: Microprocessor-controlled, temperature compensated; capable of returning supplied battery(s) from fully discharged to fully charged condition within time required by NFPA 111 and UL 924 unless otherwise indicated.
   3. Provide automatic low voltage battery disconnect to prevent battery "deep discharge" damage.

H. Enclosures:
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   2. Hinged Doors: Lockable, with all locks keyed alike.
   3. Finish: Manufacturer's standard unless otherwise indicated.

I. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category B.

J. Automatic Sequence of Operations:
   1. Upon failure or degradation of primary/normal input power, transfer load to battery power.
   2. When primary/normal input power has been restored, retransfer load to primary/normal power and recharge battery.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of inverter assemblies are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive inverter assemblies.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install inverter assemblies in accordance with applicable requirements of NECA 416.

C. Install products in accordance with manufacturer's instructions.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Provide required support and attachment in accordance with Section 260529.

F. Install inverter assemblies plumb and level.

G. Unless otherwise indicated, mount floor-mounted inverter assemblies on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
D. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank.
E. Prepare and start system in accordance with manufacturer's instructions.
F. Perform acceptance test in accordance with NFPA 111.
G. Inspect and test in accordance with NETA ATS, except Section 4.
H. Perform inspections and tests listed in NETA ATS, Section 7.22.2.
I. Batteries and Charger: Perform inspections and tests listed in NETA ATS, Section 7.18.
J. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of emergency lighting inverter system to Owner, and correct deficiencies or make adjustments as directed.
B. Training: Train Owner's personnel on operation, adjustment, and maintenance of emergency lighting inverter system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Location: At project site.

3.06 PROTECTION

A. Protect installed inverter assemblies from subsequent construction operations.

3.07 MAINTENANCE

A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of emergency lighting inverter system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

END OF SECTION

SECTION 263999
BATTERY ENERGY STORAGE SYSTEMS (BESS)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Battery Energy Storage System

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
B. Section 260526 - Grounding and Bonding for Electrical Systems.
C. Section 260529 - Hangers and Supports for Electrical Systems.
D. Section .
E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
F. Section 263100 - Photovoltaic Systems: For use in conjunction with battery energy storage systems specified in this section.
G.
H.

1.03 REFERENCE STANDARDS

A. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

1.04 EMERGENCY POWER SUPPLY

A. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 RATINGS

A. NFPA 111 - Standard on Stored Electrical Energy Emergency and Standby Power Systems; 2025.
B. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
C. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
    1. Where applicable, include characteristic trip curves for overcurrent protective devices upon request.
C. Provide interconnection between cabinets.

1. Indicate any inverter load restrictions.
2. Identify mounting conditions required for equipment seismic qualification.

D. Shop Drawings: Indicate dimensions, input/output voltages, power ratings, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, and installed features and accessories.

E. Specimen Warranty: Submit sample of manufacturer's warranty.

F. Evidence of qualifications for manufacturer.

G. Evidence of qualifications for installer.

H. Evidence of qualifications for maintenance contractor (if different entity from installer).

I. Manufacturer's equipment seismic qualification certification.

J. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

K. Manufacturer's certification that products meet or exceed specified requirements.

L. Source quality control test reports.

M. Provide NFPA 111 required documentation from manufacturer where requested by authorities having jurisdiction.

N. Manufacturer’s detailed field testing procedures.

O. Field quality control test reports.

P. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

Q. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

R. Maintenance contracts.

S. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.07 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 101 (Life Safety Code).
   3. NFPA 111; meet requirements for Level 1 system.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   1. Authorized service facilities located within 200 miles of project site.
   2. ISO 9001 certified.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with centralized emergency lighting inverter systems of similar size, type, and complexity; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

1. Contract maintenance office located within 200 miles of project site.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to inverter system components, enclosure, and finish.

D. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Inverter Assemblies: Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

C. Batteries: Provide pro-rata warranty for the duration of rated design life.

PART 2 PRODUCTS - BATTERY ENERGY STORAGE SYSTEM

GOAL:

MAXIMUM SYSTEM VOLTAGE: 1500V

A. POWER DEMAND MODE—RESPOND TO EXTERNAL POWER DEMAND

PV SYSTEM SHOULD BE DESIGNED TO PROVIDE 120KW DC_P POWER USING A DC COUPLED BATTERY SYSTEM THAT CAN PROVIDE 500KWH DC / 467.239 KWH-AC OF ENERGY WITH THE MAX. POSSIBLE PEAK POWER OF 170KW DURING A 24HR POWER OUTAGE PERIOD. PV SYSTEM SHOULD ALSO PROVIDE 193,000 KWH/YEAR TO OFFSET THE FACILITY ENERGY CONSUMPTION. PV + BATTERY SYSTEM SHOULD PROVIDE THE POSSIBILITY OF CONNECTING A PORTABLE DIESEL GENERATOR TO THE SWITCHBOARD WHEN NEEDED. THE PARALLEL OPERATION OF THE PV + BATTERY SYSTEM AND THE PORTABLE DIESEL GENERATOR IS PROHIBITED.

WARRANTY:

REFER TO THE ATTACHED 10-YEAR O&M FOR DETAILS.

PV PANELS:

MANUFACTURED UNITS:

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY THE FOLLOWING:

B. SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE HANWHA Q-CELLS Q.PEAK DUO XL-G10.2 480W OR COMPARABLE PRODUCT.

PERFORMANCE REQUIREMENTS:

A. NRTL (NATIONALLY RECOGNIZED TESTING LABORATORY) LISTING: ENTIRE ASSEMBLY SHALL BE LISTED AND LABELED BY A QUALIFIED TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION FOR ELECTRICAL AND FIRE SAFETY, CLASS A ACCORDING TO UL 1703.

SYSTEM SIZE, CHARACTERESTICS & SPECIFICATIONS:

A. TOTAL SYSTEM SIZE: 120KW DC

B. TOTAL ENERGY YIELD: MINIMUM 193,000 KWH

C. MINIMUM ELECTRICAL CHARACTERISTICS:

RATED OPEN CIRCUIT VOLTAGE (VOC): 53.61

MAXIMUM SYSTEM VOLTAGE: 1500V

MAXIMUM POWER AT VOLTAGE (VPM): 44.81

RATED SHORT-CIRCUIT CURRENT (ISC): 11.26

RATED OPERATION CURRENT (IMP): 10.71

MAXIMUM POWER AT STC (PMAX): 480W

MODULE EFFICIENCY: 20.7%

POWER TOLERANCE: +5W/-0W

MINIMUM REVERSE CURRENT: 20A

PV MODULE CLASSIFICATION: CLASS II

FIRE RATING BASED ON ANSI/UL 61730: C/TYPE 1

PERMITTED MODULE TEMPERATURE ON CONTINUOUS DUTY: -40°C/+85°C

MECHANICAL SPECIFICATIONS:

A. FORMAT (INCLUDING FRAME): 2216MM X 1045MM X 35MM

B. WEIGHT: 26.5KG

C. FRONT COVER CONSTRUCTION: 3.2MM THERMALLY PRE-STRESSED GLASS WITH ANTI-REFLECTION TECHNOLOGY

D. BACK COVER CONSTRUCTION: COMPOSITE FILM

E. FRAME CONSTRUCTION: ANODISED ALUMINUM

F. CELL: 6 X 26 MONOCRYSTALLINE Q.ANTUM SOLAR HALF CELLS

G. JUNCTION BOX: 53-101MM X 32-60MM X 15-18MM PROTECTION CLASS IP67, WITH BYPASS DIODES

H. CABLE: 4 MM² SOLAR CABLE; (+)≥70MM, (-)350MM

I. CONNECTOR: STÄUBI MC4-EVO2, HANWHA Q CELLS HQC4; IP68

CARPORT:

MATERIAL: STRUCTURE FRAME: COLD GALVANIZED HI TENSILE 55 KSI BOX BEAM PLATE TO PLATE.

FRAMING: SQUARE AND COLD-FORMED CHANNELS SHALL BE BOLTED/TEKED TOGETHER IN THE FILED WITHOUT ADDITIONAL FABRICATIONS OR FIELD WELDING.

COLUMNS: COLUMNS SHALL BE IMBEDDED IN CONCRETE PIER FOOTING.

ROOFING: ROOFING SHALL BE SECURED WITH SELF-TAPPING SCREWS. STRUCTURES UP TO 40’ DEEP SHOULD USE SINGLE ROOF RUNNING FROM FRONT TO REAR, SO END LAPS ARE ELIMINATED.

DRAINAGE: 5 DEGREE ROOF SLOPE TO FRONT OR REAR AS REQUIRED.

DESIGN STANDARD: ALL LIGHT GAUGE COLD-FORMED STRUCTURAL PANELS SHALL BE DESIGNED IN ACCORDANCE WITH THE SPECIFICATIONS FOR THE DESIGN OF “LIGHT GAUGE COLD-FRAMED STRUCTURAL MEMBERS” AS PUBLISHED BY THE AMERICAN IRON AND STEEL INSTITUTE.

WIND LOAD: STRUCTURES SHALL BE DESIGNED PER SITE SPECIFIC CURRENT CODE REQUIREMENTS.

ROOF LOAD: STRUCTURES SHALL BE DESIGNED PER SITE SPECIFIC CURRENT CODE REQUIREMENTS.

ROOFING: DEEP-RIB PANELS SHALL BE COLD-FORMED FROM HI-TENSILE LIGHT GAUGE STEEL WITH A MINIMUM YIELD POINT OF 80,000/ 50,000 OR 33,000 PSI STEEL OF EQUIVALENT SECTION PROPERTIES. PANELS SHALL BE FURNISHED WITH A GALVANIZED FINISH.

HARDWARE AND ACCESSORIES: GALVANIZED OR CHROMATE-DIPPED HARDWARE FURNISHED WITH ONE PERCENT (1%) EXCESS.

FOUNDATION WORK: DRILLING PIER FOOTING AND CONCRETE PLACEMENT. ASSUME 2000 PSI SOIL BEARING PRESSURE. DRILLED FOOTINGS SHALL BE FURNISHED WITH A SMALL CONCRETE CROWN AROUND THE STEEL COLUMN FOR PROPER RUN-OFF.

INVERTER (PCS-POWER CONDITIONING SYSTEM):

INVERTER OUTPUT SHALL INTERCONNECTS WITH THE POWER GRID AND PROVIDES FLEXIBILITY FOR VARIOUS FUNCTION CONFIGURATIONS:

A. POWER DEMAND MODE—RESPOND TO EXTERNAL POWER DEMAND

IN POWER DEMAND MODE, INVERTER SHALL RESPOND TO THE EXTERNAL POWER DEMANDS AND PROVIDES THE REQUIRED ACTIVE/REACTIVE POWER TO THE GRID.

B. PEAK SHAVING MODE—SCHEDULING PEAK SHAVING FOR DEMAND CHARGE REDUCTION

IN PEAK SHAVING MODE, ONCE DETECTING THE LOAD CONSUMPTION EXCEEDING THE USER-CONFIGURED LIMIT VALUE, THE INVERTER WILL DISPATCH BATTERY POWER TO SHAVE THE PEAK AND AVOID HIGH DEMAND CHARGE.

C. GRID SUPPORT MODE—IMPROVE GRID POWER QUALITY

INVERTER SHALL ACTIVELY COMPENSATE POOR GRID VOLTAGE AND FREQUENCY BY PROVIDING ACTIVE OR REACTIVE POWER. THE COMPENSATION RATIO SHOULD BE USER CONFIGURABLE.

D. STANDALONE MODE—A RELIABLE BACKUP POWER

ONCE DETECTING GRID BLACKOUTS, THE INVERTER SHALL DISCONNECT FROM THE GRID AND TRANSITION TO STANDALONE MODE, AND CONTINUOUSLY PROVIDE QUALITY POWER FROM BATTERY TO THE CRITICAL LOAD TO REDUCE THE LOSS OR DAMAGE CAUSED BY SUCH GRID ABNORMAL SITUATION.

MANUFACTURED UNITS:

A. MANUFACTURER: DELTA PCS125

B. QUANTITY: 2

C. TOTAL CAPACITY: 250 KW

INVERTER SPECIFICATIONS:

AC GRID CONNECTION:

A. RATED GRID VOLTAGE: 480VAC, 3 PHASE

B. GRID VOLTAGE RANGE: 423 TO 528 VAC (-12%, +10%)

C. RATED GRID FREQUENCY: 60HZ

D. FREQUENCY RANGE: 59.3 HZ TO 60.5 HZ, ADJUSTABLE

E. RATED AC POWER: 125 KVA

F. RATED AC CURRENT: 150.4 A

G. MAX. CONTINUOUS AC CURRENT: 167 ARMS

H. CURRENT THD: IEEE 1547 COMPLIANT, <5% AT RATED POWER

I. POWER FACTOR: -1 TO 1, CONTINUOUSLY ADJUSTABLE

DC CONNECTION:

A. DC VOLTAGE RANGE: 750 TO 1000 VDC

B. RATED DC VOLTAGE: 900 VDC

C. RATED DISCHARGE POWER: 129 KW

D. RATED CHARGE POWER: 122 KW

E. MAX. DISCHARGE DC CURRENT: 172 A (129 KW @ 750 VDC)

F. MAX. CHARGE DC CURRENT: 163 A (122 KW @ 750 VDC)

STANDALONE OPERATION:

A. RATED OUTPUT VOLTAGE: 80 VAC, 3P3W (IN 3P4W CASE, AN EXTERNAL DYN TRANSFORMER

IS REQUIRED)

B. RATED OUTPUT POWER: 125 KVA/125 KW WITH LINEAR LOAD / 100 KVA WITH NON-

LINEAR/RCD LOAD

C. RATED OUTPUT CURRENT: 150.4 A WITH LINEAR LOAD / 120A WITH NON-LINEAR/RCD LOAD

D. RATED OUTPUT FREQUENCY: 60 HZ ± 1%

E. POWER FACTOR: 0.8 TO 1

F. OUTPUT VOLTAGE ACCURACY: 1%

G. OUTPUT VOLTAGE THD: <3% @ 12.5~100% LINEAR LOAD / <5% @ 12.5~100% NON-

LINEAR LOAD

H. OUTPUT VOLTAGE REGULATION: <10%, AT DYNAMIC; RECOVERING WITHIN TOLERANCE 10

100MS

ENVIRONMENTAL:

A. MAX. ALTITUDE: 3,000 M (9,843 FT)

B. OPERATING TEMPERATURE: -25~60°C (-13~140°F), DERATING >50°C (3%/°C), ≤200M /

-25~40°C (-13~104°F), >2000M

C. STORAGE TEMPERATURE: -25~70°C (-13~158°F)

D. HUMIDITY: 0 TO 95% RH, NO-CONDENSING

E. COOLING: FORCED AIR W/ SPEED CONTROL

F. ACOUSTIC NOISE: <72 DBA @ 1M (6.6 FT) AT RATED CONDITION

G. ENCLOSURE TYPE: TYPE 3R (IP54 EQUIVALENT)

H. INGRESS RATING: IP54

INTERFACE:

A. USER INTERFACE: 4.9 IN LCD SCREEN WITH OPERATION BUTTON, FAULT LEDS

B. EMERGENCY STOP: LOCAL EPO BUTTON & REMOTE CONTROL

C. COMMUNICATION: RS-485 / MODBUS RTU, CAN

PERFORMANCE:

A. PEAK EFFICIENCY / CEC EFFICIENCY: 97.8% / 97.5%

B. STANDBY LOSS: <20 W

MECHANICAL:

A. DIMENSIONS (W X D X H): 23.6 IN X 31.5 IN X 68.3 IN

B. NET WEIGHT: 672 LBS

COMPLIANCE:

A. CERTIFICATE: UL1741, UL1741 SA, IEEE1547, RULE 21, FCC PART 15 CLASS A

BATTERY SYSTEM:

MANUFACTURED UNITS:

A. MANUFACTURER: SYL 1P 280S, 251 KWH

B. QUANTITY: 2

C. TOTAL BATTERY SYSTEM CAPACITY: 502 KWH

BATTRY CELL SPECIFICATIONS:

A. MAKE: CATL

B. BATTERY CHEMISTRY: LFP

C. SHAPE: PRISMATIC

D. DIMENSION: 173.9 MM W X 71.7 MM D X 207.2 MM H

E. WEIGHT: 5.34 ± 0.3 KG

F. NOMINAL CAPACITY: 280 AH

G. NOMINAL ENERGY: 896 WH

H. NOMINAL VOLTAGE: 3.2 VDC

I. OPERATING VOLTAGE: 2.8 ~ 3.6 VDC

J. OPERATING TEMPERATURE RANGE: CHARGE 6~60°C / DISCHARGE -20~60°C

K. CERTIFICATES: UL 9540A, UN38.3, IEC62619

L. ACTIVE PROTECTION: SHORT CIRCUIT, OVER-CHARGING, OVER-DISCHARGING, HIGH TEMPERATURE, EXTRUSION, AND OTHER SAFETY FEATURES.

MODULE SPECIFICATIONS:

A. MAKE: SYL

B. CONFIGURATION: 1P 10S

C. KEY COMPONENT: 10 CELLS, MODULE BMU

D. DIMENSION: 220 MM W X 230 MM D X 990 MM H

E. WEIGHT: 70 KG

F. NOMINAL CAPACITY: 280 AH

G. NOMINAL ENERGY: 8.96 KWH

H. NOMINAL VOLTAGE: 32 VDC

I. OPERATING VOLTAGE: 28.0 ~ 36.0 VDC

J. MAXIMUM POWER: 4.48 KW

K. STORAGE TEMPERATURE: -30~60°C

L. STORAGE HUMIDITY: ≤85%

BATTERY RACK SPECIFICATIONS:

A. MAKE: SYL

B. CONFIGURATION: 1P 280S

C. NUMBER OF MODULES: 28

D. KEY COMPONENT: 28 MODULES, 1 BSPU

E. SWITCHGEAR POSITION: TOP

F. DIMENSION: 1,480 MM W X 2,330 MM D X 1,390 MM H

G. WEIGHT: 3,000 KG

H. NOMINAL CAPACITY: 280 AH

I. NOMINAL ENERGY: 250.88 KWH

J. NOMINAL VOLTAGE: 896 VDC

K. OPERATING VOLTAGE: 784 ~ 1,008 VDC

L. MAXIMUM POWER: 63 (0.25CP) KW

M. OPERATING TEMPERATURE RANGE: CHARGE 0~45°C / DISCHARGE -20~45°C

N. STORAGE TEMPERATURE: -30~55°C

O. STORAGE HUMIDITY: ≤95%

P. DEGREE OF PROTECTION: IP54

BATTERY MANAGEMENT SYSTEM:

BESS SHALL EMPLOY A SOPHISTICATED, MULTILEVEL BATTERY MANAGEMENT SYSTEM (BMS) FOR SYSTEM MONITORING AND CONTROL. EACH BATTERY MANAGEMENT SYSTEM SHOULD INCLUDE:

A. MODULE BATTERY MANAGEMENT UNIT (BMU)

B. RACK BATTERY MANAGEMENT CONTROLLING SYSTEM (RBMS)

C. SYSTEM-LEVEL BMS (SMBS)

ENERGY MANAGEMENT SYSTEM (EMS):

MANUFACTURED UNITS:

A. MANUFACTURER: MOTIVE ENERGY

B. QUANTITY: 1

MAJOR COMPONENTS:

A. POC-515 AMD RYZEN V1605B ULTRA-COMPACT EMBEDDED QUAD-CORE 15W/ 45W CPU

C. ADVANTECH SMARTSTART SL302 4G LTE CELLULAR ROUTER & GATEWAY

D. WALL-MOUNT TYPE NEMA 4 ENCLOSURE

E. CONTROL-BY-WEB X-400 WEB ENABLED IO CONTROLLER AND X17 EXPANSION MODULES

SPECIFICATIONS:

A. DIMENSIONS: 30 IN H X 30 IN W X 12 IN D

B. WEIGHT: 120 LBS

C. AC POWER: 120VAC, 50HZ~60HZ

D. OPERATING TEMPERATURE: -25°C~+70°C

E. COMMUNICATIONS: ETHERNET, CELLULAR, DIGITAL IO, WIFI

F. DIGITAL INPUTS: 8 (OPTICALLY ISOLATED, 3~26VDC)

G. RELAY OUTPUTS (SPDT/FORM A): 8 (2.5A, 125VAC, 30VDC)

H. THERMOCOUPLES: 2 (INTERNAL AND EXTERNAL)

AUTOMATIC TRANSFER SWITCH:

MANUFACTURED UNITS:

A. MANUFACTURER: THOMSON TS 870 SERIES

B. QUANTITY: 1

SPECIFICATIONS:

A. POLES: 3 POLE

B. CONFIGURATION TYPE: ATS

C. AMPERAGE: 1200 A

D. OPERATION TYPE: OPEN TRANSITION

E. SAFETY STANDARD: UL 1008 (NON - SERVICE ENTRANCE RATED)

F. VOLTAGE: 277/480V

G. CONTROLLER: TSC 900 C/W GHC GRAPHIC DISPLAY

H. ENCLOSURE TYPE: NEMA 3R DD, ASA #61 GRAY – TS-H2

I. UTILITY SWITCHING DEVICE: MOLDED CASE SWITCH C/W ELECTRONIC & GF TRIP (250-1200A)

J. GENERATOR SWITCHING DEVICE: MOLDED CASE SWITCH (100-1200A)

K. POWER CONNECTIONS: STANDARD

L. ATS CONNECTION CONFIGURATION: STANDARD

GROUND AND ARC FAULT REDUCTION DEVICE:

MANUFACTURED UNITS:

B. QUANTITY: 2

SPECIFICATIONS:

GENERAL FUNCTIONS

A. DEVICE CAPABILITIES: COMBINED GROUND AND ARC FAULT DETECTOR AND INTERRUPTER/DISCONNECT FOR PV STRINGS

B. MAX. VOLTAGE RATING PER INPUT: 1000V

C. MAX. CURRENT RATING PER INPUT: 25A

D. NUMBER OF INDIVIDUAL INPUTS: 4

E. MAX. STRING INPUTS: 8

F. COMMON GROUNDING: NEGATIVE TERMINAL, OPTIONALLY POSITIVE

G. INTERFACES: MODBUS RTU RS485, UP TO 24V DIGITAL I/OS

H. FAULT LATCH: YES

I. DISCONNECT: YES

J. RESET: YES

K. FAULT/STATUS INDICATORS: YES

L. GROUND FAULT CURRENT TRIP LEVEL: CONFIGURABLE FROM 100MA TO 1A

POWER SUPPLY

A. INTERNAL ON BOARD: 1500V TO +24V

B. EXTERNAL: +24V

INDICATORS

A. POWER ON: RED LED

B. CHANNEL STATUS (4): TWO COLOR LED. GREEN-CLOSED. RED-OPEN.

CONTROLS

A. STOP: LOCAL E-STOP, GLOBAL E-STOP, MODBUS COMMAND

B. RESET: LOCAL RESET, MODBUS COMMAND

STANDARDS & COMPLIANCE

A. CERTIFICATIONS: UL1741 (GROUND FAULT), UL1699B (ARC FAULT)

ENVIRONMENTAL

A. STORAGE TEMPERATURE: -40°C TO 60°C

B. ENVIRONMENTAL RATING: NEMA 4 & IP66

C. COOLING: CONVECTION

D. HUMIDITY: 0-95%

E. OPERATING AMBIENT TEMPERATURE: -5°C TO 50°C

PHYSICAL CHARACTERISTICS

A. SIZE: 0.55M H X 0.42M W X 0.27M D

B. WEIGHT: 20KG

PV STRING LEVEL DC-DC OPTIMIZER:

MANUFACTURED UNITS:

A. MANUFACTURER: ALENCON SPOT 1000

B. QUANTITY: 2

SPECIFICATIONS:

INPUT

A. MAX. NUMBER OF MPPTS/INPUTS PER SPT: 4

B. MAX. STRING VOLTAGE: 1000V

C. STRING OPERATING VOLTAGE: 200-1000V

D. MPPT VOLTAGE RANGE: 200-880V

E. MAX. CURRENT PER INPUT/DEVICE: 25A/100A

F. REVERSE POLARITY PROTECTION: YES

G. MAX. POWER PER INPUT/DEVICE @ 25°C: 22 KW/88 KW

H. MAX. POWER PER INPUT/DEVICE @ 50°C: 16.94 KW/67.76 KW

I. GROUNDING CONFIGURATION: POSITIVE, NEGATIVE OR FLOATING

OUTPUT

A. OUTPUT OPERATING VOLTAGE: FULLY CONFIGURABLE FROM 200 TO 1500V

B. MAX. NUMBER OF OUTPUTS: 4

C. REVERSE POLARITY PROTECTION: YES

D. GROUNDING CONFIGURATION: FLOATING

EFFICIENCY

A. PEAK EFFICIENCY: 98.5%

B. CEC WEIGHTED EFFICIENCY: 98%

STANDARDS & COMPLIANCE

A. CERTIFICATIONS: UL1741, IEC 62109-1, CSA C22.2

ENVIRONMENTAL

A. STORAGE TEMPERATURE: -40°C TO 85°C

B. COOLING: NATURAL CONVECTION OR FORCED AIR

C. ENVIRONMENTAL RATING: NEMA 3R & IP66

D. HUMIDITY: 0-95%

E. OPERATING AMBIENT TEMPERATURE: -40°C TO 50°C

PHYSICAL CHARACTERISTICS

A. SIZE: RAIL MOUNT: 642MM X 416MM X 311MM / RACK MOUNT: 8U/353MM X 486MM X 637MM / (HEIGHT WITH FEED: 9U)

B. WEIGHT: 54KG (WITH FEED: ADD 14 KG)

ADDITIONAL FEATURE

A. COMMUNICATIONS – REQUIRED ACE: WIRED OR WIRELESS – MODBUS TCP PROTOCOL

B. AFCI-REQUIRES GARD: UL1699B

C. GFCI-REQUIRES GARD: UL1741

ISOLATION TRANSFORMER:

MANUFACTURED UNITS:

A. MANUFACTURER: EATON / HAMMOND / SCHNEIDER / GE / SIEMENS

B. QUANTITY: 1

SPECIFICATIONS:

A. PRIMARY VOLTAGE: 480V DELTA

B. SECONDARY VOLTAGE: 480 Y 277V

C. CAPACITY: 300KVA

D. TEMPERATURE RISE: 150° C

E. INSULATION CLASS: 200°C

EFFICIENCY

A. PEAK EFFICIENCY: PER DOE 2016 STANDARD 10 CFR PART 431

STANDARDS & COMPLIANCE

A. CERTIFICATIONS: UL 1561

ENVIRONMENTAL

A. ENCLOSURE RATING: NEMA 3R

B. COOLING: NATURAL CONVECTION

D. HUMIDITY: 0-95%

E. OPERATING AMBIENT TEMPERATURE: -5°C TO 50°C

PHYSICAL CHARACTERISTICS

A. SIZE: 52” X 37.5” X 34”

B. WEIGHT: 1950LB

ADDITIONAL FEATURE

A. HIGH EFFICIENCY ALUMINUM WINDINGS

B. VACUUM PRESSURE IMPREGNATED WINDINGS

C. PRIMARY ADJUSTMENT TAPS PROVIDED

AC COMBINER:

MANUFACTURED UNITS:

A. MANUFACTURER: EATON / SCHNEIDER / GE / SIEMENS

B. QUANTITY: 1

SPECIFICATIONS:

A. VOLTAGE RATING: 480V DELTA

B. CURRENT RATING: 400A

C. OCPD: CIRCUIT BREAKER

STANDARDS & COMPLIANCE

CERTIFICATIONS: NEMA PB1

ENVIRONMENTAL

A. ENCLOSURE RATING: NEMA 3R

B. HUMIDITY: 0-95%

C. OPERATING AMBIENT TEMPERATURE: -5°C TO 50°C

PHYSICAL CHARACTERISTICS

A. SIZE: 36” X 36” X 12”

B. WEIGHT: 200LB

ADDITIONAL FEATURE

A. TIN PLATED ALUMINUM MAIN BUS BARS

B. SYSTEM GROUND BUS

C. FULL-SIZE INSULATED STAND-OFF NEUTRAL BARS

PV VISIBLE BLADE DISCONNECT SWITCH:

MANUFACTURED UNITS:

A. MANUFACTURER: EATON / SCHNEIDER / GE / SIEMENS

B. QUANTITY: 1

SPECIFICATIONS:

A. VOLTAGE RATING: 480V DELTA

B. CURRENT RATING: 600A

STANDARDS & COMPLIANCE

CERTIFICATIONS: NEMA KS-1

ENVIRONMENTAL

A. ENCLOSURE RATING: NEMA 3R

B. HUMIDITY: 0-95%

C. OPERATING AMBIENT TEMPERATURE: -5°C TO 50°C

PHYSICAL CHARACTERISTICS

A. SIZE: 36” X 52.7” X 16”

B. WEIGHT: 200LB

ADDITIONAL FEATURE

A. LOCKABLE

B. SWITCH BLADES READILY VISIBLE IN THE ‘ON’ AND ‘OFF’ POSITION

C. PAINT COLOR SHALL BE ANSI 61 GRAY

DC COMBINER:

MANUFACTURED UNITS:

A. MANUFACTURER: SHOALS / SOLARBOS / OTHERS

B. QUANTITY: 1

SPECIFICATIONS:

A. VOLTAGE RATING: 1000V DELTA

B. CURRENT RATING: 150A

C. OCPD: FUSES

STANDARDS & COMPLIANCE

CERTIFICATIONS: UL 50

ENVIRONMENTAL

A. ENCLOSURE RATING: NEMA 3R

B. HUMIDITY: 0-95%

C. OPERATING AMBIENT TEMPERATURE: -5°C TO 50°C

PHYSICAL CHARACTERISTICS

A. SIZE: 36” X 72” X 16”

B. WEIGHT: 400LB

ADDITIONAL FEATURE

A. DISCONNECT SWITCH

B. SYSTEM GROUND LUG

371.01 CENTRALIZED EMERGENCY LIGHTING INVERTERS - GENERAL REQUIREMENTS

A. Provide complete centralized emergency lighting inverter system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Inverter Assemblies: Manufactured units consisting of inverters, batteries, enclosures, and associated components specifically designed for emergency lighting applications; microprocessor-based utilizing pulse width modulation (PWM) with insulated gate bipolar transistors (IGBT's); listed and labeled as complying with UL 924.
   1. Battery Run Times of 90 Minutes: Listed as complying with UL 924 for "emergency lighting and power equipment".
   2. Battery Run Times Other than 90 Minutes: Listed as complying with UL 924 for "auxiliary lighting and power equipment".

D. Provide inverters and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Increase indicated power ratings as required to accommodate any applicable inverter load restrictions.

F. Inverters Installed in Spaces Used for Environmental Air: Plenum rated; listed and labeled as complying with UL 2043, suitable for use in air-handling spaces.

G. Battery System:
   1. Provide battery capacity as required for achieving battery run time indicated.
   2. Battery Charger: Microprocessor-controlled, temperature compensated; capable of returning supplied battery(s) from fully discharged to fully charged condition within time required by NFPA 111 and UL 924 unless otherwise indicated.
   3. Provide automatic low voltage battery disconnect to prevent battery "deep discharge" damage.

H. Enclosures:
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   2. Hinged Doors: Lockable, with all locks keyed alike.
   3. Finish: Manufacturer's standard unless otherwise indicated.

I. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category B.

J. Automatic Sequence of Operations:
   1. Upon failure or degradation of primary/normal input power, transfer load to battery power.
   2. When primary/normal input power has been restored, retransfer load to primary/normal power and recharge battery.

PART 3 EXECUTION

372.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of inverter assemblies are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive inverter assemblies.

E. Verify that conditions are satisfactory for installation prior to starting work.

372.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install assemblies in accordance with applicable requirements of NECA 416.
C. Install products in accordance with manufacturer's instructions.
D. Arrange equipment to provide minimum clearances and required maintenance access.
E. Provide required support and attachment in accordance with Section 260529.
F. Provide required seismic controls in accordance with Section .
G. Install assemblies plumb and level.
H. Unless otherwise indicated, mount floor-mounted inverter assemblies on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
I. Provide grounding and bonding in accordance with Section 260526.
J. Identify inverter assemblies and associated system wiring in accordance with Section 260553.

372.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.
B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.
D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank.
F. Prepare and start system in accordance with manufacturer's instructions.
G. Perform acceptance test in accordance with NFPA 111.
H. Inspect and test in accordance with NETA ATS, except Section 4.
I. Perform inspections and tests listed in NETA ATS, Section 7.22.2.
J. Batteries and Charger: Perform inspections and tests listed in NETA ATS, Section 7.18.
K. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

372.04 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.
B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

372.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.
B. See Section 017900 - Demonstration and Training, for additional requirements.
C. Demonstration: Demonstrate proper operation of emergency lighting inverter system to Owner, and correct deficiencies or make adjustments as directed.
D. Training: Train Owner's personnel on operation, adjustment, and maintenance of emergency lighting inverter system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

372.06 PROTECTION

A. Protect installed inverter assemblies from subsequent construction operations.

372.07 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of emergency lighting inverter system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 4 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION

SECTION 264300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.
B. Surge protective devices for distribution locations.
C. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.
B. Section 262300 - Low-Voltage Switchgear.
C. Section 262413 - Switchboards.
D. Section 262416 - Panelboards.
E. Section 262419 - Motor-Control Centers.
F. Section 262513 - Low-Voltage Busways.

1.03 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.
B. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.
F. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
   1. UL 1449.
   2. UL 1283 (for Type 2 SPDs).

E. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

G. Project Record Documents: Record actual connections and locations of surge protective devices.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

B. Substitutions: See Section 016000 - Product Requirements.

C. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.
   2. Outdoor locations: Type 3R.

C. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
   1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
   2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

D. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 5,000 impulses.

F. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.04 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Distribution locations include SPDs connected to distribution panelboards, motor control centers, and busway.

D. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

E. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.

F. Repetitive Surge Current Capacity: Not less than 3,500 impulses.

G. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.05 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 2,000 impulses.

F. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.04 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.
B. Emergency lighting units.
C. Exit signs.
D. Drivers.
E. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems.
B. Section 260533.16 - Boxes for Electrical Systems.
C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 260923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
F. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.
G. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.
B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).
C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
D. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.
E. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.
F. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.
I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.
K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

N. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

O. UL 1598 - Luminaires; Current Edition, Including All Revisions.

P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

D. Samples:
   1. Provide one sample(s) of each luminaire where indicated.

E. Field quality control reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
   3. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
   4. Extra Drivers: Two percent of total quantity installed for each type, but not less than one of each type.

I. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for LED luminaires, including drivers.

C. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, drivers, reflectors, lenses, housings and other components required to position, energize and protect the source and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
   1. LED Tape - General Requirements:
      a. Listed.
      b. Designed for field cutting in accordance with listing.
      c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
   2. White LED Tape:
      a. Color Rendering Index (CRI): Not less than 90.

J. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Sealed maintenance-free lead calcium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

G. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.

H. Accessories:
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
   2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   3. Provide compatible accessory wire guards where indicated.
   4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.04 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

2.05 LED DRIVERS

A. LED Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
   3. LED Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

E. Provide required support and attachment in accordance with Section 260529.

F. Provide required seismic controls in accordance with Section 260548.

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
   7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

I. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

O. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

P. Identify luminaires connected to emergency power system in accordance with Section 260553.

Q. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 265600
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.
B. Poles and accessories.
C. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.
B. Section 260526 - Grounding and Bonding for Electrical Systems.
C. Section .
D. Section 260533.16 - Boxes for Electrical Systems.
E. Section .
F. Section 260923 - Lighting Control Devices: Automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.
G. Section 262726 - Wiring Devices: Receptacles for installation in poles.
H. Section 262813 - Fuses.
I. Section 265100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.
B. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; 2013, with Editorial Revision (2025).
C. 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; 2023.
D. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).
E. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.
F. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
G. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.
H. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.
I. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

K. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

L. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 1598 - Luminaires; Current Edition, Including All Revisions.

O. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
   2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.
   3. Provide structural calculations for each pole proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
   3. Lamps: Include rated life and initial and mean lumen output.
   4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

E. Samples:
   1. Provide one sample(s) of each specified luminaire where indicated.

F. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

G. Field Quality Control Reports.
   1. Include test report indicating measured illumination levels.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
   3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.
   4. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
   5. Touch-Up Paint: 2 gallons, to match color of pole finish.

K. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
   1. LED Tape - General Requirements:
      a. Listed.
      b. Designed for field cutting in accordance with listing.
      c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
   2. White LED Tape:
      a. Color Rendering Index (CRI): Not less than 90.

J. Exposed Hardware: Stainless steel.

2.03 LED DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.04 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Structural Design Criteria:
      a. Comply with AASHTO LTS.
      b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
   3. Material: Steel, unless otherwise indicated.
   4. Shape: Square straight, unless otherwise indicated.
   5. Finish: Match luminaire finish, unless otherwise indicated.
   6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.

7. Unless otherwise indicated, provide with the following features/accessories:
   a. Top cap.
   b. Anchor bolts with leveling nuts or leveling shims.
   c. Anchor base cover.
   d. Provision for pole-mounted weatherproof GFI receptacle where indicated.
   e. Hinged base.

B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.05 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section .

F. Provide required seismic controls in accordance with Section .

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Pole-Mounted Luminaires:
1. Maintain the following minimum clearances:
a. Comply with IEEE C2.
b. Comply with utility company requirements.
2. Foundation-Mounted Poles:
a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 033000.
1) Install anchor bolts plumb per template furnished by pole manufacturer.
2) Position conduits to enter pole shaft.
b. Install foundations plumb.
c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
d. Tighten anchor bolt nuts to manufacturer's recommended torque.
e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
f. Install anchor base covers or anchor bolt covers as indicated.
3. Embedded Poles: Install poles plumb as indicated.
4. Grounding:
a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
b. Provide supplementary ground rod electrode as specified in Section 260526 at each pole bonded to grounding system as indicated.
5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
6. Install non-breakaway in-line fuse holders and fuses complying with Section 262813 in pole handhole or transformer base for each ungrounded conductor.
7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 262726 in designated poles.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

E. Measure illumination levels at night with calibrated meters to verify conformance with performance requirements. Record test results in written report to be included with submittals.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.09 ATTACHMENTS

A. Luminaire schedule.

B. Luminaire cut sheets.

END OF SECTION

SECTION 311000
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and grubbing of the site, including the removal of debris, vegetation, foreign objects, concrete slabs and foundations, asphalt paving, portland concrete paving and curbs, site lighting and bases, site walls, area drains and catch basins, unwanted existing underground utilities and drain lines, conduits, trees, and other site construction as indicated and as required for grading the site suitable for constructing the proposed project.

1.02 RELATED REQUIREMENTS

PART 2 PRODUCTS

2.01 MATERIALS

A. Sedimentation Barrier: See Section 015713 - Temporary Erosion and Sediment Control.

B. Fill Material: As indicated in the Project Geotechnical Report and approved by the Geotechnical Engineer.

PART 3 EXECUTION

3.01 PREPARATION

A. Erect barriers, fences, guard rails, enclosures, and shoring to protect personnel, structures, the public, and site improvements and utilities to be maintained intact.

B. Protect and maintain benchmarks and survey control points from disturbance during construction.

C. Locate and clearly flag trees and vegetation to remain or be relocated.

D. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.02 SITE CLEARING

A. Comply with additional requirements specified in Section 017000 - Execution and Closeout Requirements.

B. Identify potential dust sources.

C. Fill depressions caused by clearing and grubbing operations with material satisfactory to the geotechnical engineer unless further excavation or earthwork is indicated.

D. Place fill material in horizontal layers in accordance with the recommendations in the project geotechnical report and compact each layer to a density satisfactory to the geotechnical engineer.

3.03 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths is encountered in a manner to prevent intermingling with underlying subsoil or other waste.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.04 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with local requirements; obtain required permits.

B. Protect existing utilities, utility structures, and associated appurtenances to remain from damage.

C. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's Representative written permission.

D. Do not disrupt public utilities without permit from authority having jurisdiction.

E. Protect existing structures and other elements that are not to be removed. Remove unwanted existing utilities as indicated or as uncovered by work, and cap in a manner conforming to Code. Determine status of utility lines encountered that are not shown on the Contract Drawings. If abandoned, remove and dispose of in proper manner.

F. Install sedimentation barrier according to Section 015713 - Temporary Erosion and Sediment Control.

G. Develop dust remediation controls and methods. Do not use water if that results in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

H. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Check with local jurisdiction for any needed inspection permits.

3.05 CLEARING AND GRUBBING

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, trash enclosure area, paving, lawns, and planting beds.

B. Clear site after relocating vegetation in accordance with ANSI A300 Part 6.

C. Preservation of existing vegetation: The construction schedule shall consider the amount and duration of soil exposed to erosion by wind, rainfall, and vehicle tracking and seek to minimize disturbed soil during the rainy season. A schedule shall be prepared that shows the sequencing of construction activities with installation of maintenance of soil stabilization and sediment control BMPs.

D. Do not remove or damage vegetation beyond limits indicated on drawings.

E. Install substantial, highly visible fences at least 6 feet high to prevent inadvertent damage to vegetation to remain:
   1. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
   2. Around other vegetation to remain within vegetation removal limits.

3. See Section 015000 for fence construction requirements.

F. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum subsoil disturbance.

3.06 REMOVED VEGETATION PROCESSING

A. Do not burn, bury, landfill, or leave on-site, except as indicated on drawings.

3.07 SITE IMPROVEMENTS

A. Remove existing above and below grade improvements as indicated and as necessary to facilitate new construction.

B. Demolish and completely remove existing construction as indicated from the site, including subsurface conditions designated to be removed or required to be removed to facilitate the work of the proposed project.
   1. Demolish asphalt, concrete, and masonry in small sections. Continuously wet down debris to prevent creation of dust or fire hazard.
   2. Fragments: Remove from the site asphalt and concrete fragments exceeding 6 inches in maximum dimension.

3.08 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and windblown debris from public and private lands.

END OF SECTION

SECTION 312200
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough grading.

1.02 RELATED REQUIREMENTS

A. Section 311000 - Site Clearing.
B. Project Geotechnical Report.
C. Standard Specifications for Public Works Construction (Greenbook); current edition.

1.03 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with the Standards Specifications for Public Works Construction (Greenbook); current edition.
B. Perform work in accordance with Project Geotechnical Report.

PART 2 PRODUCTS

2.01 MATERIALS

A. Gravel: Excavated on-site.
   1. Graded according to ASTM D2487 Group Symbol GW, GP, or SP.
B. Fill Material: As indicated in the Project Geotechnical Report and approved by the Geotechnical Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify survey bench mark and intended elevations for grading areas are as indicated.
B. Verify the absence of standing or ponding water.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.
B. Stake and flag locations of known utilities.
C. Locate, identify, and protect above- and below-grade utilities to remain.

D. Provide temporary means and methods to remove standing or ponding water from areas prior to grading.

E. Protect site features to remain, including but not limited to bench marks, survey control points, and fences.

3.03 ROUGH GRADING

A. Excavate and fill subgrade material to elevations indicated on plans.

B. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
   1. Remove sod, grass, and any other vegetation before stripping top soil.
   2. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
   3. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.
   4. Strip topsoil to depth indicated on drawings.

C. Horizontally bench existing slopes greater than _____.

D. Replace displaced subgrade in accordance with Section 312323.

E. Remove and replace unsuitable materials as specified fill.

3.04 FINE GRADING

A. Scrape and spread subgrade material uniformly smooth and without disruptions as indicated on drawings.

3.05 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.
   1. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water and other erosion control measures.
      a. Limit height of topsoil stockpiles to 72 inches.
      b. Do not stockpile topsoil within plant protection zones.
      c. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or resued.

B. Stockpile subsoil to be re-used on site; remove remainder from site.

3.06 TOLERANCES

A. Top Surface: Plus or minus 1/2 inch.

3.07 FIELD QUALITY CONTROL

A. Compaction density testing shall be as described in the Project Geotechnical Report and as approved by the Geotechnical Engineer.

3.08 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove unused stockpiled subsoil. Grade stockpile area to prevent standing water.

C. Leave site clean and raked, ready to receive work.

END OF SECTION

SECTION 316316
AUGER-PLACED PILES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section specifies excavation, grout, and reinforcing required for the construction of auger-placed piles.

B. Work Included
   1. Furnish all labor and materials required to construct auger-placed piles complete, including layout, excavation and removal of spoils, fabrication and placement of reinforcing steel, furnishing and placing grout, and pile load testing.

C. Related sections include the following:
   1. 014000 - Quality Requirements for materials testing and inspection during construction.
   2. Division 1 Section “Geotechnical Report” for subsurface investigation.
   3. 012200 - Unit Prices for a list of unit prices.
   4. 031000 - Concrete Forming and Accessories concrete forming material.
   5. 032000 - Concrete Reinforcing concrete reinforcing.
   6. 033000 - Cast-in-Place Concrete: cast-in-place concrete

1.03 DEFINITIONS

A. Auger-placed pile (also called auger cast-in-place pile): Pile formed by rotation of a continuous-flight, hollow-shaft auger into the ground to the specified depth, embedded into the bearing stratum, or until the specified refusal criteria are satisfied. Grout is then injected through the auger shaft as the auger is being withdrawn in such a way as to exert a positive upward grout pressure as well as a positive lateral pressure on the soil surrounding the grout-filled pile hole. The reinforcing steel is placed while the grout is still fluid to complete the pile installation.

B. Engineer: Structural Engineer-of-Record

C. Inspector: Qualified representative of the Geotechnical Engineer

1.04 UNIT PRICES

A. Basis for Bids:
   1. The contract price shall be based on the base length of piles shown on the Drawings plus an amount for pile load tests.
   2. Do not include permanent casing for each pile in the Base Contract Sum for piles.
      a. Unit prices shall be as follows: Price per lineal foot longer than total base length.
      b. Price per lineal foot shorter than total base length.
      c. Unit prices shall include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, reinforcement, grout fill, and other items for complete auger-placed pile installation.

B. Basis for Payment: Payment of auger-placed piles will be made on actual total length of piles in place and approved. Actual length and shaft diameter may vary to coincide with elevations where satisfactory bearing strata are encountered.
   1. Adjustment to the Contract shall be based on total length of piles placed, not on length of individual piles placed.ACI PRC-213

1.05 REFERENCE STANDARDS

A. ACI 305R - Guide to Hot Weather Concreting; 2020.
B. ACI 306R - Guide to Cold Weather Concreting; 2016.
C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014.
D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2025.
E. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
F. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2024.
G. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
H. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements; 2021.
I. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.
J. ASTM C937 - Standard Specification for Grout Fluidifier for Preplaced-Aggregate Concrete; 2023.
K. ASTM C939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method); 2022.
L. ASTM C942 - Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory; 2021.
M. ASTM D1143/D1143M - Standard Test Methods for Deep Foundation Elements Under Static Axial Compressive Load; 2020.
N. Augered Cast-In-Place Piles Inspector's Guide - Augered Cast-In-Place Piles Inspector's Guide, Second Edition, 2010; 2010.
O. Augered Cast-In-Place Piles Manual - Augered Cast-In-Place Piles Manual, Third Edition, with 2023 Errata; 2023.

1.06 SUBMITTALS

A. Submittals for Review:
   1. Description of the pile drilling and grout pumping equipment to be utilized.
   2. Pile Grout Design Mix: Include description and proportions of materials to be utilized. Mix designs shall be based on one of the following based on ACI 301, Section 4:
      a. Laboratory test reports of trial mixes made with the proposed materials.
      b. Laboratory test reports of mixes used on previous projects with record of past performance of at least 30 consecutive strength tests.
   3. Grout mix designs shall include the following information:
      a. Proportions of cement, fine aggregate, and water
      b. Design strength
      c. Type of cement and aggregates
      d. Type and quantity of all admixtures
      e. Flow rate of grout when tested in accordance with ASTM C939 using a 3/4 inch diameter flow cone.

4. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, length, material, grade, bar schedules, tie spacing, bar arrangement, splices and laps, and supports for pile reinforcement.
    a. Include method of centralizing the reinforcing within grouted shaft, including size and type of device, and locations on reinforcing.
    b. Structural drawings shall not be reproduced for shop drawings.
5. Pile identification plan referenced to the structural plans showing:
    a. The location and a numbering system for identifying each individual pile.
    b. The sequence of pile installation so as to provide the specified separation between piles installed on the same day.
6. Pile Load Test: Dimensioned sketch of the loading arrangement, including sizes of reaction members, data on testing and measuring equipment including required current jack, dial gauge, and/or load cell and monitoring instrumentation calibrations. Include load testing methods, and loading schedule and duration.
7. If proposed to be used on the project, submit a description of the automated monitoring equipment (AME) proposed to measure and record drilling progress during the augering phase, and incremental volume pumped during the grouting phase.
8. If specified on the project, submit a description of the method of non-destructive testing (NDT) to be performed on selected ACIP piles.

B. Submittals for Information:
1. Procedures for
    a. Calibrating the grout pump
    b. Monitoring the amount of grout placed
    c. Monitoring grout pressures during pumping
2. Equipment Data: Description of drilling and grout-pumping equipment, including the following:
    a. Type and make of drilling rig, rated capacity, and boom lengths.
    b. Torque of drilling machine and horsepower of hydraulic power unit.
    c. Pressure and discharge capacity of grout pump.
    d. Automated monitoring equipment to be used, if applicable.
3. Submit copies of the installation record of each pile within 24 hours after the pile is placed. The Architect shall be notified immediately of any “Problem Piles” that do not meet the requirements of the Contract Documents so that the issue can be rectified immediately and redrilling/regrouting or replacement piles can be addressed.
4. Load test reports: Reports prepared in accordance with the applicable ASTM and/or governing Code Standards. Submit within three days of completing each test.
5. Experience record of pile Contractor's and on-site personnel qualifications.

1.07 QUALITY ASSURANCE

A. Installer: Company specializing in performing the work of this Section with minimum three (3) projects in similar soil conditions, and with similar pile diameters, depths, and quantities. The pile contractor superintendent shall have a minimum of five (5) years of method specific experience. The pile contractor shall have technical qualifications, experience, trained personnel and facilities to install auger-placed piles as specified.
1. Contractor shall be a member of Deep Foundations Institute

B. Survey Work: Engage a registered professional land surveyor to perform layout of auger-placed piles.
1. Record and maintain information pertinent to each auger-placed pile and cooperate with Owner’s testing and inspecting agency to provide data for required reports.

C. Auger-Placed Test Pile: Construct trial auger-placed pile of diameter and depth and location indicated or, if not indicated, of same diameter and depth as typical auger-placed piles located at least three diameters clear of permanent piles, to demonstrate Installer's construction methods, equipment, standards of workmanship, and tolerances.
   1. Fill with grout, install reinforcement, and terminate trial pile 12 inches below grade unless detailed otherwise.
   2. Install reaction piles if required to perform load test. Location of reaction piles shall maintain same minimum spacing from permanent piles as indicated above.
   3. If, in the opinion of the Architect/Engineer, test pile locations shown are not representative of the area, alternate locations will be provided by the Engineer.
   4. Test pile data will be used to verify pile design load. If test pile fails the load test, additional load tests or an increase in length of piles may be required.
   5. Load testing shall be performed in accordance with method outlined in, unless otherwise changed or revised by the Engineer. Following standard load testing procedure (2 times the design load), load test the pile to 3 times the design load or to failure, whichever occurs first, allowing about 20 minutes between load increments.

D. Preinstallation Conference: Conduct a conference at the Project site before auger-placed pile installation equipment mobilization to the site.
   1. The meeting shall be attended by the:
      a. Owner
      b. Architect
      c. Structural Engineer
      d. Geotechnical Engineer
      e. Geotechnical Engineer's Inspector
      f. Grout testing agency
      g. General Contractor
      h. Pile Contractor.
   2. The means/methods, inspection, acceptance/rejection criteria, and testing procedures shall be established and documented at this meeting. Any supplemental or modified procedures agreed to at the meeting shall be documented in writing and distributed to all attendees prior to the start of work.

E. All piles may be subject to being evaluated utilizing non-destructive testing (NDT) methods.

1.08 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating with an auger-placed pile. If utilities are to remain in place, protect from damage during auger-placed pile operations.
   1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adjust the drilling procedure as necessary to prevent damage to these utilities.
   2. Cooperate with the Owner and utility companies to keep services and facilities operational. Repair damaged utilities to the satisfaction of the utility owner.

B. Site Information: A geotechnical report has been prepared for this Project and is referenced elsewhere in the Project Manual for information only.
   1. Information regarding site conditions is provided for the convenience of the Contractor and is not a warranty that the information represents site conditions that may be encountered. The Owner shall not be responsible for interpretations or conclusions drawn from the information provided by the Contractor.
   2. The Contractor may conduct additional borings or other exploratory work at no cost to the Owner.

C. The Pile Contractor shall examine the areas and conditions under which piles are to be installed and notify the General Contractor and/or Architect/Engineer in writing of conditions detrimental to the proper and timely completion of the work.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain Steel Wire: ASTM A82, as drawn.

C. Bar Supports: Furnish spacers to maintain the required concrete cover to the sides and bottom of the excavation.
   1. Shaftspacer Systems, Foundation Technologies, Inc., Tucker, Georgia
   2. "Centraligner" and "Hijacker", Pearesearch, Arlington, Texas

D. Mechanical splices: Provide mechanical splices designed to develop, in tension and compression, 125 percent of the minimum ASTM specified yield strength of te smaller bar being spliced. The following splicing systems are acceptable:
   1. Erico "Cadweld T-Series"
   2. Erico "Lenton"
   3. Dayton Barsplice "Bar Grip"
   4. Dayton Barsplice "Grip Twist"

2.02 GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II or ASTM C595/C595M. Supplement with the following:
   1. Fly Ash: ASTM C618 , Class C or F.

B. Fine Aggregate: Sand utilized as fine aggregate shall meet the requirements of ASTM C33/C33M.

C. Water: Potable, complying with ASTM C94 requirements. Recycled/reclaimed water may be used, provided its inclusion and associated temperature do not adversely impact the design compressive strength of the mix.

D. Grout Fluidifier: Grout fluidifier shall conform to ASTM C937 and CRD – C619, except that expansion shall not exceed 4 percent. The fluidifier shall be a compound possessing characteristics that will increase the flowability of the mixture, assist in the dispersal of cement grains, and neutralize the setting shrinkage of the high-strength cement mortar.

2.03 GROUT MIXES

A. The grout shall consist of Portland cement, fine aggregate, water, and may also contain a mineral admixture and approved fluidifier. The components shall be proportioned and mixed to produce a grout capable of maintaining solids in suspension and being pumped efficiently. These materials shall be proportioned to produce a hardened grout that will achieve the design strength within 28 days. The design 28-day grout strength for this project shall be 4,000 psi. The consistency of the grout shall be tested in accordance with ASTM C939 using a 3/4-inch diameter flow cone, and the flow rate shall range from 12 to 22 seconds.
   1. All materials shall be accurately measured as they are fed into the mixer.
   2. The mixing time shall be a minimum of one minute at the site. If agitated continuously, the grout may be held in the mixer or agitator for a period not to exceed 2-1/2 hours at a grout temperature below 70 degrees Fahrenheit, or for a period not to exceed 2 hours at a grout temperature between 70 and 100 degrees Fahrenheit.
   3. Grout shall not be placed when its temperature falls below 40 degrees Fahrenheit or exceeds 100 degrees Fahrenheit, unless approved procedures for cold and hot weather grouting are followed.

4. Protect grout from physical damage or reduced strength that could be caused by frost, freezing action, low temperature, or damage during high temperatures in accordance with ACI 305R and ACI 306R.
5. When ambient temperatures exceed 95 degrees Fahrenheit it is permissible to allow a grout temperature of up to, 105 degrees Fahrenheit provided the mixing time is reduced to 1-1/2 hours and a set retarder is added to the mix.
6. Adding Water to Grout On-Site: The amount of water that may be added to provide both consistent and adequate flow characteristics must not compromise the specified grout strength, or if specified, the water/cement (w/c) ratio. The total amount of water required to provide adequate flow may exceed the amount listed in the mix design. In this case, the amount of added water shall be recorded by both the Testing Agency and the Inspector, and samples shall be taken for compression testing.

2.04 EQUIPMENT

A. Augering Equipment: The augering equipment shall be capable of advancing the auger of specified diameter to the specified embedment within the bearing strata.
   1. The auger flights shall be continuous from the auger head to the top of the auger without gaps or other breaks. The auger flights shall be uniform in diameter throughout their length and shall be the diameter specified for the piles, less a maximum of 3 percent. The auger cutting teeth shall be regularly inspected for wear and replaced if the specified reduction in diameter tolerance occurs. Pitch of the auger flights shall not exceed nine inches.
   2. The hole through which the high-strength grout is pumped into the pile shall be located at the bottom of the auger head below the bar containing the cutting teeth.
   3. Augers over 40 feet in length shall contain a middle guide.
   4. The piling leads shall be prevented from rotating by a stabilizing arm by firmly placing the bottom of the leads into the ground or by some other available means. Leads shall be marked at one-foot intervals and numbered at least every foot to facilitate measurement of auger penetration.

B. Mixing and Pumping Equipment:
   1. Only accepted pumping and mixing equipment shall be used in the preparation and handling of the grout. A screen to remove oversized particles shall be placed at the pump hopper or inlet. All oil or other rust inhibitors shall be removed from mixing drums and grout pumps. All materials shall be such as to produce a homogeneous grout of the desired consistency and strength.
   2. The grout pump shall be a positive displacement piston-type pump capable of developing displacement pressures at the pump of not less than 350 psi.
      a. The grout pump shall be equipped with an operable pressure gauge and a stroke counter, both of which are visible to the equipment operator.
      b. The grout pump shall be calibrated at the beginning of the work to determine the volume of grout pumped per stroke. It shall be periodically recalibrated when deemed necessary by the Inspector during the project.
      c. The Contractor shall provide a positive method of counting grout pump strokes. Such methods may include digital or mechanical stroke counters or other acceptable methods. A second pressure gauge shall be provided near the auger rig, where inspectors can readily observe it.

C. Automated Monitoring Equipment (AME)
   1. Piles may be installed and monitored during installation to obtain incremental pumped grout volumes using automated monitoring equipment (AME).

D. Miscellaneous

1. Provide schedule 40 PVC pipes, diameter to be coordinated with the testing lab, of the same length as the specified length of the pile, capped at one end, in the test pile(s) and in additional piles as specified to be subject to sonic integrity logging on the drawings and specifications, and elsewhere at the Contractor's option. Provide centering devices for the PVC pipe.

2.05 TESTING MATERIALS

A. Load Test Instrumentation
   1. Load test instrumentation specified to be installed in the test pile(s) shall be identified on a drawing showing the type of instrument and elevation.

PART 3 - EXECUTION

3.01 GENERAL

A. Piles shall be installed with due consideration for the safety of adjacent structures and existing active utilities, using a method that preserves their strength and develops and retains the required load-bearing capacity.

B. Site Conditions:
   1. Do not install piles until the earthwork in the area has been completed:
      a. Excavations: Earth excavation shall be complete before piles are installed. Remove excess spoil from the excavated area.
      b. Fills: Construct and compact fills to the elevation of the grade shown. Remove excess spoils from fill area.

3.02 PILE LOAD TEST

A. Allowable pile load shall be determined by load tests on the piles shown. Contractor shall conduct load tests per ASTM D1143/D1143M, standard loading procedure. No additional piles shall be installed until test reports of test piles are received and approved by the Architect and Engineer of Record.

B. Test Piles:
   1. Test piles shall be of type and shall be placed in a manner specified, utilizing identical equipment, methods, and materials for production piling. If, in the opinion of the Engineer of Record or the Geotechnical Engineer, the test pile locations shown are not representative of the area, alternate locations will be provided by the Engineer of Record.
   2. If the test pile fails the load test, additional load tests or an increase in the pile length may be ordered.
   3. Do not incorporate the test pile into the Work.
   4. The Geotechnical Engineer shall approve the test pile length.

3.03 FABRICATION

A. Fabricate reinforcing cages in the required lengths before drilling the pile holes.
   1. Spacers: Provide specified spacers to maintain the position of cages within the pile holes.
   2. Splices: Provide specified mechanical splices if the bar cage is required to be spliced for any reason.

3.04 INSTALLATION

A. The length and drilling criteria of production piles will be as determined by the Owner's Geotechnical Consultant from the results of the pile load tests.

B. Grout shall be pumped as soon as practicable after mixing, and in no case shall grout be used that does not reach its final position in the pile within 1-1/2 hours after truck-mixed grout leaves the plant, as evidenced by the delivery ticket provided to the inspector.

C. Advance the auger at a continuous rate that prevents the removal of excess soil. Stop advancement after reaching the required embedment into the bearing strata or when the refusal criteria are met.

D. Auger refusal is defined as a rate of auger penetration of less than 1 foot per minute of drilling, based on the use of a power unit having a minimum rated torque of 9000 foot -pounds.

E. The hole in the bottom of the auger shall be plugged to prevent soil intrusion into the stem as it is advanced into the ground. The plug shall be fabricated from steel tubing to fit snugly into the hole. The plug shall be removed by grout pressure or with the reinforcing bar.

F. Grout shall be pumped with an initial pressure of approximately 250 psi at the pump as the auger is withdrawn, allowing the mortar to fill the hole, preventing its collapse, and permitting lateral intrusion of the mortar into the surrounding soil. A second pressure gauge shall be provided, located as close to the augering rig as possible, such that it is just touching the ground when the auger is in the raised position. The range of this gauge shall not exceed twice the normal pumping pressure.

G. The grout pump shall be equipped with a calibrated pressure gauge, clearly visible to the equipment operator. A digital counter shall be used to measure the number of grout pump strokes during the installation process. The grout pump shall be calibrated at the beginning of the Work to determine the number of pump strokes to fill a 55-gallon drum with mortar.
   1. The Contractor and the Inspector should agree upon the calibration factor to be used.
   2. Pump shall be recalibrated following repair or switching pumps, or at least once at the request of the inspector during pile installation.
   3. The Contractor shall maintain a spare counter and a spare pump on hand. A spare pump shall be utilized when the primary pump is not functioning properly or when directed by the Inspector.

H. At the start of pumping grout, raise the auger from 6 to 12 inches off the bottom to expel the tip plug. After the grout pressure builds up sufficiently, the auger shall be lowered back down.

I. Maintain a head of at least ten feet of grout on the auger above the injection point as the auger is raised. Positive rotation of the auger shall be maintained throughout the placement of the grout. The rate of grout injection and the rate of auger withdrawal from the soil shall be coordinated to maintain the minimum grout head at all times, and a positive pressure shall be maintained on the gauges.
   1. The total volume of grout shall be at least 115 percent of the theoretical volume for each five-foot segment of pile. The total volume of grout may be reduced to 100 percent of the theoretical when grout is flowing at the ground surface from the auger flights.
   2. If pumping of grout is interrupted for any reason or if a return at the surface is noted, the Contractor shall lower the auger at least five feet below the level where the interruption occurred while continuously pumping grout.

J. The grout quantity shall be determined by counting pump strokes and using the pre-determined grout volume per pump stroke. Sufficient grout shall be placed in each pile to achieve a minimum grout factor of 1.15, but not less than the test piles (volume placed divided by the theoretical shaft volume).

K. If less grout is placed than the net volume required for any five-foot increment, the piles shall be reinstalled by rotating the auger to the bottom of the pile, followed by controlled removal and grout injection.

L. Auger hoisting equipment shall be provided that will enable the auger to be rotated while being withdrawn smoothly and steadily. Augers in excess of 40 feet in length shall be provided with a traveling guide.

M. Reinforcing Cages: Place reinforcing bars into the grouted pile hole immediately after the auger is removed and support at the ground surface until initial set. Allow cages to fall into the shaft freely under their own weight; do not force by vibrating or pushing with mechanical equipment. Use bar spacers to center reinforcing bars.
   1. Bars required to be spliced shall be spliced using mechanical splices.

N. Piles shall be drilled and grouted in one continuous operation. The pile contractor shall confirm that sufficient grout is available on-site prior to beginning construction of each pile. Grout that has achieved initial set or has otherwise become unworkable shall not be used for pile construction and shall be discarded.

O. Provide grout injection equipment with a pressure gauge in clear view of the equipment operator. A second pressure gauge shall be located near the auger rig where it can be observed. The rate of injection and the rate of auger withdrawal from the soil shall be so coordinated as to maintain at all times a positive gauge pressure that will indicate the existence of a removing pressure on the bottom of the auger flight. The magnitude of this pressure and the performance of other augering and grouting procedures, such as rate of augering, rate of grout injection, and control of grout return around the auger flight, are dependent on soil conditions, and equipment capability shall be at the option of the Contractor, subject to approval of the Inspector. Equipment for pumping grout shall be a positive displacement pump capable of developing a pressure at the pump of not less than 350 psi. Remove oil or other rust inhibitors from mixing drums and pumps. Auger hoisting equipment shall be capable of withdrawing the auger smoothly and at a constant rate. If the auger jumps upward during withdrawal, it shall be reinserted, and the rate of withdrawal decreased to prevent further jumping.

P. Do not place piles closer than 4 pile diameters or 8 feet center to center, whichever is greater, until grout in adjacent piles has set for 24 hours.

Q. Provide steel casing where necessary to stop the loss of grout into subsurface voids.

R. Pile Completion
   1. Cut off the tops of piles, square with the pile axis and at the elevations indicated by removing fresh grout from the top of the pile or by cutting off hardened grout down to the final cut-off point at any time after initial set has occurred.
   2. Where the pile cut-off is near or above grade, sleeves or casing of the proper diameter and at least 18 inches in length shall be placed around the pile tops.
   3. The level of grout in completed piles shall be measured and recorded after initial grout set, and shall be periodically inspected for settlement. Should settlement occur, the pile may be filled with grout provided that any deleterious materials that may have accumulated on top of the setting grout have been removed.
   4. Special attention shall be paid to inspecting the level of grout in completed piles while installing adjacent piles.
   5. The spoil and excess grout that accumulates around the auger during the drilling process and injection of the grout shall be promptly cleared away so that the installation can be properly inspected. Excess grout and spoil shall be removed from the Work area at the end of each day. Do not use a backhoe or equivalent equipment adjacent to freshly placed piles within 48 hours to avoid possible damage to reinforcement and piling.

S. Tolerances:
   1. Install piles within the following maximum tolerances:
      a. Location: Within 3 inches from the plan location indicated for each pile.
      b. Plumbness: Maintain within 2 percent of the pile length.
      c. Pile cut-off elevation shall be not more than 1 inch above, and not more than 2 inches below the required elevation.
      d. Pile diameter: Minus 0 inches

3.05 OBSTRUCTIONS:

A. If non-augurable material is encountered above the desired tip elevation, such as cobbles, boulders, rock, metal, timbers or debris, which causes auger refusal (refusal is defined as a rate of auger penetration of less than one foot per minute of drilling), the Engineer of Record shall be notified. Then the pile shall be completed to the depth of the non-augurable material per these specifications.
   1. Care shall be taken during auger advancement to prevent prolonged drilling or excessive rotation, which could result in ground subsidence or settlement due to the removal of excessive volumes of soil.
   2. The reduced length of such piles shall be included in the total linear feet of pile for payment at the unit price.
   3. If required by the Architect/Engineer, additional adjacent piles shall be placed, and the length of these additional piles shall also be included in the total linear feet of piles for payment.

3.06 FIELD QUALITY CONTROL

A. Inspection: The Owner shall employ a qualified representative of the Geotechnical Engineer (“Inspector”) to provide continuous inspection of all pile operations. The Pile Contractor shall cooperate with the Inspector in the performance of this work. The presence of the Owner’s Geotechnical representative shall in no way relieve the Pile Contractor of his obligation to perform the pile installation per the Drawings and these Specifications. The Inspector shall meet the requirements outlined in the “Augured Cast-In-Place Piles Inspector's Guide.” The Inspector shall observe and inspect the following prior to the start of construction:
   1. The pile contractor’s equipment shall be inspected when delivered to the site to confirm that the auger length is sufficient to drill to the specified depth. Pile leads shall be clearly and accurately marked at one-foot intervals.
   2. The diameter of the auger and bit shall be measured to ensure compliance with the project specifications. Auger flighting shall be continuous with no gaps and shall be in good condition with uniform diameter throughout the entire length. Auger and bit diameter shall be within ¼ inch of the specified diameter.
   3. Grout pumping equipment (pump, hoses, swivels, connections, etc.) shall be checked to confirm that the pump and appurtenances are appropriately sized to develop and maintain the specified grout pressure and delivery volume. The grout pump shall be calibrated to determine the volume per pump stroke, allowing for the proper evaluation of the grout volume placed in the piles. If the grout pump includes a stroke counter, the counter shall be inspected to ensure that it operates correctly.
   4. Pressure gauges shall be inspected to confirm proper operation and placement. At a minimum, pressure gauges shall be located at the pump discharge port, the crane leads, and at the inlet point to the auger column. All gauge faces shall be readable and properly calibrated.
   5. At the start of pile construction operations, the location and orientation of the auger column and leads shall be checked to confirm that the pile is being constructed at the proper location and that the auger and leads are plumb and true to the specified pile orientation.
   6. The pile Inspector shall record all applicable pile installation data. Specific attention shall be given to conditions or practices that may result in adequate pile construction. Any pile not installed according to the specifications shall be re-drilled or re-placed.
   7. Sonic Integrity Monitoring
      a. Test 100 percent of the piles on the first day of installation, and 10 percent of the total number of piles unless directed otherwise by the geotechnical engineer.

B. Reports: The Inspector shall maintain an installation record of each pile.
   1. The record shall note the following:

a. Date and time the pile is placed
b. ASC Profiles, Inc.
c. Pile location
d. Pile design capacity
e. Pile diameter
f. Pile tip (bottom) elevation
g. Pile top elevation
h. Length of pile
i. Total quantity of grout placed, determined by automatic recording of grout pump displacement or by other acceptable means.
j. Reinforcing steel placement
k. Any unusual occurrences during the pile installation.

2. Submit copies of the installation record of each pile within 24 hours after the pile is placed. The Architect shall be notified immediately of any “Problem Piles” that do not meet the requirements of the Contract Documents so that the issue can be addressed immediately.
3. The Inspector shall also maintain a daily report, which summarizes all auger-cast pile work performed by the Contractor.
4. During grouting operations, representative samples of the grout mix shall be obtained from the pump hopper for evaluation of initial set time and for later compliance testing for compressive strength.

C. Grouting of each pile:
1. Grout testing: Make and test six, 2-inch cubes for every 50 cubic yards of grout placed, or at least one set for each day during which piles are placed. A set of six cubes shall consist of two cubes to be tested at seven days, two cubes to be tested at 28 days and two cubes held in reserve. Test cubes shall be cured and tested in accordance with ASTM C109/C109M. Cube specimens may be restrained from expansion as described in ASTM C942.
2. Flow test each batch of grout in accordance with ASTM C939 using a 3/4-inch diameter flow cone. More frequent flow tests shall be performed on questionable (either too fluid or excessively thick) batches of grout.
3. Inspect reinforcing cages
a. Bar sizes and quantity
b. Check the tying and splicing of cages
c. Monitor placement
4. Grout placement
a. Inspect grout techniques and conditions
b. Inspect grout quality at the tops of pile caps

D. Post-Construction Testing: Completed piles or questionable piles may be specified for post-construction non-destructive testing (NDT).

3.07 CORRECTIONS OF DEFICIENCIES

A. The Contractor shall notify the Architect and Engineer in writing of the failure of a pile to meet any requirement of the Section. Such written notification shall include all information necessary for evaluating remedial measures, including all information required for redesign.

B. Based on the survey provided, if the Engineer determines that the pile fails to meet the design criteria, then the Contractor shall perform such remedial work as the Engineer, in his sole discretion, may require, including but not limited to furnishing and installing additional piles at locations approved by the Engineer. These corrective measures shall be performed at the Contractor’s expense.

C. If a pile fails to comply with the requirements of this Section and the Engineer determines that modification to concrete or reinforcement steel, or the drilling of additional piles is necessary, the Engineer will perform all required reanalysis, redesign and detailing.

D. Abandoned piles shall be cut off one foot below the elevation of the bottom of the pile cap or mat, as shown on the Contract Drawings, and will not be paid for.

3.08 CLEAN UP

A. All debris from excavation of objectionable material, removal of obstructions, and any material not to remain as part of the construction shall be removed and legally disposed of off the Owner's property.

B. The site shall be cleaned at frequent intervals, and no material shall be stored on the site in a manner that would obstruct the easy access of equipment and personnel.

END OF SECTION

SECTION 316329
DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Dry-installed straight shaft drilled piers.

1.02 WORK INCLUDED

A. Furnish all labor and materials required to construct drilled concrete piers complete including layout, excavation of shafts, excavation of belled bottoms, temporary steel casings, fabrication and installation of reinforcing steel, furnishing and placing concrete, setting anchor bolts and removal of spoil.

1.03 RELATED REQUIREMENTS

A. Section 015000 - Temporary Facilities and Controls.
B. Section 031000 - Concrete Forming and Accessories.
C. Section 032000 - Concrete Reinforcing.
D. Section 033000 - Cast-in-Place Concrete.
E. Section 051200 - Structural Steel Framing, for anchor rods installed in drilled piers.

1.04 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional unit price requirements
B. Basis of Bids: Base bids on indicated number of drilled piers; design length from top elevation to bottom of shaft, extended through the bell, if applicable; and diameter of shaft and bell.
C. Basis for Payment: Payment for drilled piers will be made based on the actual net volume of drilled piers that are in place and approved. Actual length, shaft diameter and, if applicable, bell diameter may vary to coincide with elevations where satisfactory bearing strata are encountered and with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made to the net variation of total quantities based on design dimensions for shafts and bells.
    1. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, and other items for complete drilled-pier installation.
    2. See Section 01 2200 - Unit Prices, for a list of unit prices.
D. The contract price shall be based on the base lengths of the piers shown in the drawings. Unit prices shall be as follows:
    1. Unit prices per linear foot for piers longer or shorter than base lengths.
    2. Unit prices per linear foot for casing. Measurement for payment shall be from the top of the pier to the top of the bearing stratum.
E. The cost of casings shall be included in the base price for piers. If casings are not used, the Contract shall be adjusted based on the unit price.

F. Unit prices shall include all labor and materials, including overhead and fees for drilled concrete piers. Adjustments to the Contract shall be based on total linear feet greater than or less than the sum of the base lengths of each pier size. Additional penetration in the bearing stratum greater than the specified penetration shall not be included in the determination of increases or decreases of pier lengths related to adjustments in the Contract.

1.05 REFERENCE STANDARDS

A. The applicable version of the standards listed below shall be per Chapter 35 of Part 2 of the ICC (IBC)-2021, including addendums and errata. Where the standard is not listed, then the most current version of the standard shall be used or as referenced by other standards.
   1. ACI SPEC-336.1 - Specification for the Construction of Drilled Piers.
   2. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   3. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
   4. AWS D1.1/D1.1M - Structural Welding Code - Steel.
   5. CRSI (DA4) - Manual of Standard Practice.

1.06 REFERENCE STANDARDS

A. ACI SPEC-336.1 - Specification for the Construction of Drilled Piers; 2001.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

E. CRSI (DA4) - Manual of Standard Practice; 2023.

F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ICC (IBC)-2021 - International Building Code; 2021.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Submittals for Review:
   1. Shop Drawings: Indicate dimensioned plan layout, dowel and anchor bolt setting plans including templates, drilled pier shaft sizes, casing sizes, bell bottom sizes, and top elevation, and details of reinforcing steel.

C. Submittals for Information:
   1. Pier Drilling Log: Report of drilled concrete pier construction including actual elevations of top and bottom of each pier, elevation of bearing stratum, penetration into bearing stratum, deviations of pier centerline and plumbness, shaft size, bell size, presence of water, use of temporary casing, placement of concrete, and time of start and finish of excavation

D. Product Data: For each type of product indicated.

E. Design Mixes: For each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Laboratory Test Reports: For evaluation of concrete materials and mix design.

1.08 QUALITY ASSURANCE

A. Installer: Company specializing in performing the work of this Section with a minimum of three projects in similar soil and rock conditions and with similar shaft sizes, depths, and quantities.

B. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
   1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

C. Preinstallation Conference: Conduct a conference at the Project site to comply with requirements in Section 01 3000 - Administrative Requirements.

1.09 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
   1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt the drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies to keep services and facilities in operation without interruption. Repair damaged utilities to the satisfaction of the utility owner.

B. Site Information: A geotechnical report has been prepared for this Project and is included in the Project Manual.
   1. Information regarding site conditions is provided for the Contractor's convenience and is not a warranty that the information represents site conditions that may be encountered. The Owner shall not be responsible for interpretations or conclusions drawn from the information provided by the Contractor.
   2. The Contractor may conduct additional borings or other exploratory work at no cost to the Owner.

PART 2 PRODUCTS

2.01 STEEL REINFORCEMENT

A. Refer to 032000 - Concrete Reinforcing.

B. Bar Supports: Furnish spacers to maintain the required concrete cover to the sides and bottom of the excavation.
   1. Shaftspacer Systems and “BARBOOT Rebar Supports,” Foundation Technologies, Inc., Tucker, Georgia.
   2. HEAVY DUTY PIER WHEEL (QUICK-LOCK HD®)," “PIER WHEEL (QUICK-LOCK®)”, PIER WHEEL (QUICK-LOCK®) and “PIER WHEEL (QUICK-LOCK®), Pieresearch, Arlington, Texas.

2.02 CONCRETE MATERIALS

A. Provide concrete materials in accordance with 033000 - Cast-in-Place Concrete.

2.03 STEEL CASINGS

A. Steel Pipe Casings: ASTM A283/A283M, Grade C; or ASTM A36/A36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1/D1.1M.

PART 3 EXECUTION

3.01 PREPARATION

A. Installation shall comply with ICC (IBC) 1810.4.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.02 EXCAVATION

A. Unclassified Excavation: Excavation is unclassified and includes excavation to bearing elevations regardless of the character of materials or obstructions encountered.
   1. Obstructions: Unclassified excavation includes removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions.

B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

C. Excavate shafts for drilled piers to indicated diameters and elevations. Remove loose material from the bottom of the excavation.
   1. Excavate the bottom of drilled piers to a level plane within 1:12 tolerance.
   2. Remove water from excavated shafts before concreting.

D. Notify and allow the Owner's testing and inspecting agency to test and inspect the bottom of the excavation prior to placing reinforcement and concrete. If an unsuitable bearing stratum is encountered, adjust the drilled piers as determined by the Architect.
   1. Do not excavate shafts deeper than the elevations indicated unless approved by the Architect.
   2. Additional authorized excavation will be paid according to Contract provisions for changes in the Work.

E. Excavate shafts for closely spaced drilled piers and those occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

F. Temporary Casings: Conform to requirements of ICC (IBC) 1810.3.1.6.
   1. Install watertight steel casings of sufficient length and thickness to prevent water seepage into the shaft, withstand compressive, displacement, and withdrawal stresses, and maintain the stability of shaft walls.
   2. Remove temporary casings, maintained in plumb position, during concrete placement and before the initial set of concrete or temporary casings may be left in place.

G. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
   1. Maximum Variation From Vertical: One percent of length.
   2. Maximum Variation From Design Top Elevation: Plus 1 inch to minus 3 inches.
   3. Maximum Out-of-Position: One twenty-fourth of the shaft diameter or 3 inches, whichever is less.
   4. If the location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to the Architect for review before proceeding.

H. Inspection: Each drilled pier must be inspected and tested by Owner's testing and inspecting agency before placing concrete.
   1. Provide and maintain facilities with equipment required for testing and inspecting excavations. Cooperate with testing and inspecting personnel to expedite the Work.
   2. Notify the Architect and testing agency at least six hours before excavations are ready for tests and inspections.

3.03 STEEL REINFORCEMENT

A. Comply with ICC (IBC) 1810.3.9.3 and recommendations in CRSI (DA4) "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcing cages symmetrically about the axis of shafts in a single unit.

D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover to the reinforcement.

E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in the work of other Sections. Provide blocking and holding devices to maintain the required position during final concrete placement.

F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.04 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.
   1. Concrete shall be placed within the time limit stated on the Drawings.

B. Dry Method:
   1. For piers 30 inches or larger in diameter: Place concrete to fall vertically down the center of the drilled pier without striking the sides of the shaft or steel reinforcement.
   2. For piers less than 30 inches in diameter or where concrete cannot be directed down the shaft without striking reinforcing, place concrete with chutes, tremies, or pumps.
   3. Use tremies where a drop of more than 60’-0” is required.
   4. Vibrate the top 60 inches of concrete.

C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
   1. Vibrate the top 60 inches of concrete after the withdrawal of the temporary casing.

D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where the cutoff elevation is above the ground elevation, form the top section above grade and extend the shaft to the required elevation.

E. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
   1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
   3. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: The Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit reports during excavation and concrete placement for drilled piers.

B. A drilled-pier report will be prepared by the Owner's testing and inspecting agency for each drilled pier per IBC 1810.4.3 and as follows:
   1. Actual top and bottom elevations.

2. Top of rock elevation.
3. Description of soil materials.
4. Description, location, and dimensions of obstructions.
5. Final top centerline location and deviations from requirements.
6. Variation of shaft from plumb.
7. Shaft excavating method.
8. Design and tested bearing capacity of bottom.
9. Depth of rock socket.
10. Levelness of bottom and adequacy of cleanout.
11. Ground-water conditions and water-infiltration rate, depth, and pumping.
12. Description, diameter, and top and bottom elevations of temporary or permanent casings.
13. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
14. Date and time of starting and completing excavation.
15. Inspection report.
16. Position of reinforcing steel.
17. Concrete placing method, including elevation of consolidation and delays.
18. Elevation of concrete during removal of casings.
19. Locations of construction joints.
20. Remarks, unusual conditions encountered, and deviations from requirements.
21. Concrete testing results.

C. Concrete: Refer to 033000 - Cast-in-Place Concrete for sampling and testing of concrete for quality control.
   1. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
   2. Additional Tests: The testing and inspecting agency will make additional tests of concrete when test results indicate concrete strengths or other requirements have not been met.
      a. Continuous coring of drilled piers may be required, at the Contractor's expense, when temporary casings have not been withdrawn within specified time limits or where observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.

3.06 DISPOSAL OF MATERIALS

A. Remove surplus excavated material and slurry and legally dispose of it off the Owner's property.

END OF SECTION

SECTION 320190
LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, material, equipment and services required to maintain landscape in a healthy growing condition and in a neat and attractive appearance throughout the maintenance period.

1.02 RELATED REQUIREMENTS

A. Division 32 Section Landscape Irrigation

B. Division 32 Section Landscape Work

1.03 QUALITY ASSURANCE

A. The Maintenance Contractor shall be experienced in horticulture and landscape maintenance, practices and techniques, and shall provide sufficient number of workers with adequate equipment to perform the work during the maintenance period.

1.04 MAINTENANCE PERIOD

A. Continuously maintain the entire project area during the progress of the work and during the ninety (90) calendar-day maintenance period until final acceptance of the project by the Landscape Architect,
   1. Maintenance Period begins after all punchlist and corrective items have been accepted by the Landscape Architect and owner.

B. Maintenance period shall not start until all punch list items are addressed, when all elements of construction, planting and irrigation for the entire project are in accordance with Plans and Specifications. A prime requirement is that all lawn and landscape areas shall be planted and that all lawn areas shall show an even, healthy stand of grass seedlings which shall have been mown twice. If such criteria are met to the satisfaction of the Landscape Architect, a written notification shall be issued to establish the effective beginning date of maintenance period.

C. Any day of improper maintenance, as determined by the Landscape Architect, shall not be credited as an acceptable maintenance period day. The maintenance period shall be extended on a daily basis if the work is not in accordance to the Plans and Specifications. Project shall not be segmented into maintenance areas or phases, unless authorization of the Landscape Architect is obtained.

D. Maintenance shall continue beyond the ninety (90) day maintenance period, as required, until final acceptance is given by the Landscape Architect.

E. Contractor shall provide protection to the project site during the maintenance period.

F. A phased maintenance period will not be accepted.

1.05 GUARANTEE AND REPLACEMENT

A. Guarantee: All plant material and other materials installed under the Contract shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship or improper maintenance, as determined by the Landscape Architect, and shall be replaced by the Contractor at his expense. Warranty periods are as follows:

1. Trees, vines, and shrubs: One Year
2. Groundcover and Turf: One year.

B. Replacement: Any materials found to be dead, missing, declining or not in a satisfactory or healthy condition during the maintenance period shall be replaced immediately. The Landscape Architect shall be sole judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within five (5) days of written notification by the Landscape Architect or owner. All replacement materials and installations shall comply with the Plans and Specifications. Any plant missing due to suspected theft shall be replaced by the Contractor. If the Contractor suspects that theft may be a problem, the Contractor shall provide written documentation to the owner that security on this site needs to be intensified.

C. The Contractor may relieve himself of theft responsibility if after the security notice, with no result, a written notice to the owner shall be given that plant material will not be replaced for theft or vandalism due to lack of site security being maintained. This procedure may take place only during the Landscape Maintenance Period.

1.06 OBSERVATION SCHEDULE

A. Normal progress observations shall be requested by the Contractor from the Landscape Architect as per observations listed in specifications Division 32 Section "Landscape Work."

1.07 FINAL ACCEPTANCE OF THE PROJECT

A. Upon completion of all project work, including maintenance period, the Landscape Architect will, upon proper written request, make an observation to determine final project acceptability. Provide minimum a 14 business day notice for final observation.

B. Where observed work does not comply with the Plans and Specifications, replace rejected work and continue specified maintenance period until reinspected by the Landscape Architect and determined to be acceptable. All replacement materials and installations shall be in accordance with the Plans and Specifications. Remove rejected work and materials immediately from project. Prior to the date of final observation, Contractor shall provide the Landscape Architect with all Record Drawings and close out documents in accordance with the Plans and Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials used shall either conform to Specifications in other sections or shall otherwise be acceptable to the Landscape Architect. The Landscape Architect shall be given a monthly record of all herbicides, insecticides and disease control chemicals used and irrigation scheduled. The amendments listed herein are for Bidding purposes only. The final amendment types and rates shall be determined by the Agronomic Soils Test.

B. Turf maintenance fertilizer: shall be "Best Turf Supreme 16-6-8":
1. 16% nitrogen
2. 6% phosphoric acid
3. 8% potash

C. Slow Release maintenance fertilizer: shall be "Best Superturf 25-5-5 with Polyon" and shall consist of the following percents by weight:
1. 25% nitrogen
2. 5% phosphoric acid
3. 5% potash

PART 3 - EXECUTION

3.01 GENERAL MAINTENANCE

A. General: Proper maintenance, including watering, weeding, mowing, edging, fertilization, rolling of turf, replacement and infill of mulch replacement of jute mesh, infill of settled areas, repairing and protection shall be required until entire project is finally accepted, but in any event for a period of not less than the specified maintenance period after planting.

B. Watering: Thoroughly water to insure vigorous and healthy growth until work is accepted. Water in a manner to prevent erosion due to application of excessive quantities of water. When hand watering use a water wand to break the water force. Supplemental hand water as required to maintain and encourage the proper growth of new and existing plant material.

C. Weeding:
   1. Keep plant basins, turf areas and areas between plants free of weeds. Control weeds with pre-emergent herbicides. If weeds develop, use legally approved herbicides and hand remove. Avoid frequent soil cultivation that destroys shallow roots. Weeding also shall be included in all paved areas including public or private sidewalks.
   2. Hand weed as required in addition to the application of weed control herbicides and pre-emergent to maintain all areas free of weeds including turf species other than the specified species. Periodic or predetermined weeding schedules may not be adequate and should be supplemented.
   3. Apply a final application of pre-emergent herbicide at the end of the maintenance period, just prior to final acceptance.

D. Tree basins in turf areas: Remove turf from around each tree to create a 4'- 0" diameter basin depending on tree size.

E. Pruning
   1. Trees: Prune trees to select and develop permanent scaffold branches; to eliminate narrow V-shaped branch forks that lack strength; to reduce toppling and wind damage by thinning out crowns; to maintain a natural appearance and to balance crown with roots. All trees shall be maintained and pruned in accordance with the accepted practices of the American Society of Consulting Arborists (ASCA). Prune only as directed by the Registered Consulting Arborists and Landscape Architect.
   2. Shrubs: Same objectives as for trees. Shrubs shall not be clipped into balled or boxed forms unless such is required by the landscape plans. All pruning cuts shall be made to lateral branches, buds or flush with the trunk. Stubbing and heading shall not be permitted.
   3. Only skilled workers shall perform pruning work in accordance with standard horticultural pruning practices. Remove from the project all pruned branches and material. Remove and replace any plant material excessively pruned or malformed resulting from improper pruning practices at no additional costs to the owner.
   4. Improperly pruned plant material as determined by the Landscape Architect is to be replaced at no cost to the owner.

F. Staking and Guys: Stakes and guys shall remain in place through the guarantee period and shall be inspected and adjusted to prevent rubbing that causes bark wounds. Remove nursery stake from all trees that are staked with lodgepole stakes per specifications. Provide supplemental staking or guying as required during high wind events to prevent damage to trees. Any damaged tree caused by high winds must be replaced by the contractor at no cost to the owner.

G. Insect, Animal, Rodent and Disease Control: Maintain proper control with legally approved materials as required as part of the Contract.

H. Protection: The Contractor shall maintain protection of the planted areas. Damaged areas shall be repaired or replaced at the Contractor's expense.

I. Trash: Remove trash weekly in all planted areas, pedestrian walkways and parking areas. Maintain all areas free of trash, clippings, and debris at all times.

J. Replacement: As per Guarantee and Replacement Specifications of this Section.

K. Fertilization: Fertilize all planting areas, during and just prior to end of maintenance period with the slow release maintenance fertilizer as indicated in the agronomic soils report.

L. Watering: Planting areas shall be watered at such frequency as weather conditions require to replenish soil moisture below root zone and to establish healthy plant material.
   1. Contractor is responsible for water audits and payment of any local penalties by local water districts at no additional cost to the Owner.

3.02 LAWN AND TURF MAINTENANCE

A. Mowing and Edging
   1. Initial mowing of turf will commence when the grass has reached a height of two and one-half (2-1/2) inches. The height of cut will be two (2) inches. After initial establishment maintain Bermuda and creeping grasses at 1½" and fescues or rye grass at 2". Mowing will be at least every 4-6 days for the second through fifth cuttings, and at least once per week after that for fescue. Bermuda grass is to be mowed minimum twice a week. Bent grass is to be mowed daily. Turf must be well established and free of bare spots and weeds to the satisfaction of the Landscape Architect prior to final acceptance.
   2. Excess grass clippings shall be picked up and removed from the site and premises. Let turf areas dry out enough so that mower wheels do not skid, tear or mark the lawn. Edges shall be trimmed at 90 degrees to pavement, at least weekly or as needed for neat appearance. Clippings shall be removed from paved and planting areas, etc. and disposed of from the site.

B. Watering: Lawns shall be watered at such frequency as weather conditions require to replenish soil moisture below root zone and to establish healthy strands of grass.
   1. Contractor is responsible for water audits and payment of any local penalties by local water districts at no additional cost to the Owner.

C. Disease control: Control turf diseases throughout the maintenance period with legally approved fungicides and herbicides. Replace any damaged or infected grass.

D. Weed Control:
   1. Control broad leaf weeds with selective, legally approved herbicides throughout maintenance period.
   2. A final application of selective herbicide shall be applied at the end of the landscape maintenance period, acceptance, just prior to final acceptance.
   3. Hand weed as required in addition to the application of weed control herbicides and pre-emergent to maintain all areas free of weeds including turf species other than the specified species. Periodic or predetermined weeding schedules may not be adequate and should be supplemented.

E. Fertilization:
   1. During maintenance period an application of turf maintenance fertilizer, as specified, shall be made at thirty (30) day intervals from the date of maintenance period start at a rate of five (5) pounds per 1,000 square feet, and as required by the agronomic soils report.
   2. Final application (just prior to final acceptance) shall be made with the slow-release maintenance fertilizer as required by the agronomic soils report.

3. Replacement: At conclusion of maintenance period a final observation of lawn and turf areas shall be made. Remove diseased areas and unhealthy strands of grass from the site; do not bury into the soil. Replant areas with material and in a manner as specified on the Plans and Specifications at no additional cost to the Owner. All grass is to be fully grown with 100% coverage with a suitable thatch layer prior to turnover and final acceptance.

F. Arborist: Provide a written report and recommendations as required by the landscape architect if any plant material is in the sole opinion of the landscape architect, declining, stressed, infested, or otherwise not growing at the anticipated growth rate. The report is to include Agronomic Soils Test Data and recommendations and be provided at no cost to the owner.

3.03 IRRIGATION SYSTEM

A. System Observation: The Contractor shall check all systems for proper operation. Lateral lines shall be flushed out after removing the last sprinkler head or two at each end of the lateral. All heads are to be adjusted as necessary for unimpeded head to head coverage.

B. Valves: Contractor shall set, and verify that all pressure regulating valves to the operating pressure specified on the drawings.

C. Controllers: Set and program automatic controllers for seasonal water requirements. Give the Owner's Representative instructions on how to turn off system in case of emergency.

D. If the irrigation system is designed and specified to be operable from a central irrigation computer controller located off site, or a standard controller on site. The contractor shall demonstrate to Landscape Architect, Owner's Representative and future maintenance contractor that the central irrigation system is fully installed and operational from this off site control system as described and specified. Contractor shall make all adjustments as necessary to insure this operation prior to final acceptance.

E. Contractor shall set up and coordinate training for the Maintenance Contractor (Provider) on the irrigation controller, and pump with the manufactures representative. Maintenance period shall not end, and the project will not be accepted until this training has been completed.

F. Repairs: Repair all damages to irrigation system at the Contractor's expense. Repairs shall be made within twenty-four (24) hours or sooner to prevent damage to site improvements.

3.04 CLEANING

A. During maintenance work, keep pavements clean and work area in an orderly condition. Haul away and remove all debris from landscape areas, and do not leave any clippings, fertilizer, amendments and / or other material from landscape planting and/or maintenance period.

B. Powerwash all pavement and flatwork as necessary to remove all staining and tire marks on surfaces caused by maintenance or construction vehicles, prior to final acceptance.

END OF SECTION

SECTION 321123
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

1.02 RELATED REQUIREMENTS

A. Section 312200 - Grading: Preparation of site for base course.
B. Section 321216 - Asphalt Paving: Finish and binder asphalt courses.
C. Section 321313 - Concrete Paving: Finish concrete surface course.
D. Section 32815 - Synthetic Turf Surfacing (Non-Athletic)
E. Project Geotechnical Report.

1.03 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil–Aggregate Subbase, Base, and Surface Courses; 2017 (Reapproved 2021).
B. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop; 2022, with Errata .
C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2019.
D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).
E. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2024.
F. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)); 2012 (Reapproved 2021).
G. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.
H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017, with Editorial Revision (2020).
I. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2023.
J. Standard Specifications for Public Works Construction (Greenbook); current edition.
K. California State Department of Transportation Standard Specifications (Caltrans); current edition.
L. Project Geotechnical Report.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Materials Sources: Submit name of imported materials source, location, and gradation of the material.

C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Aggregate Storage, General:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate Base: Crushed aggregate base, conforming to Greenbook, Section 200-2.2.

B. Herbicide: Commercial chemical for weed control, registered by the EPA.

2.02 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements for general requirements for testing and analysis of aggregate materials.

B. Where aggregate materials are specified using ASTM D2487 classification, testing of samples for compliance will be provided before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

A. Spread aggregate over prepared substrate to a total compacted thickness as indicated on plans.

B. Place aggregate in maximum 4 inch layers and roller compact to specified density.

C. Level and contour surfaces to elevations and gradients indicated.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

G. Apply herbicide per manufacturer requirements.

3.04 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.06 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 321216
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single course bituminous concrete paving.
B. Double course bituminous concrete paving.
C. Surface sealer.

1.02 RELATED REQUIREMENTS

A. Section 312200 - Grading: Preparation of site for paving and base.
B. Section 321123 - Aggregate Base Courses: Aggregate base course.
C. Section 321313 - Concrete Paving: Concrete substrate.
D. Section 321313 - Concrete Paving: Concrete curbs.
E. Section 321723 - Pavement Markings
F. Project Geotechnical Report.

1.03 REFERENCE STANDARDS

A. AI MS-2 - Asphalt Mix Design Methods; 2015.
B. AI MS-19 - Basic Asphalt Emulsion Manual; 2008.
C. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.
D. ASTM D3549 Standard Test Method for Thickness of Height of Compacted Asphalt Mixture Specimens (2018).
E. ASTM D2950 Standard Test Method of Density of Bituminous Concrete in Place by Nuclear Methods (2020).
F. Standard Specifications for Public Works Construction (SSPWC,Greenbook); current edition.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with Standard Specifications for Public Works Construction (SSPWC) and the California Department of Transportation (Caltrans), latest editions and supplements for asphalt paving work.
B. Obtain materials from same source throughout.

1.05 **SUBMITTALS**

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1.06 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 50 degrees Fahrenheit and rising, or surface is wet or frozen.

B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Concrete: Greenbook, Section 203-6.

B. Aggregate Base Course: Section 321123.

C. Seal Coat per Greenbook, Section 203-9.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Parking lots including drive aisles and parking spaces:
   1. Wearing course: III-C3 PG 64-10 per SPPWC Section 203-6.5.
   2. Base course: III-B3 PG 64-10 per SPPWC Section 203-6.5.

B. Playgrounds/Hardcourts/Playcourts.
   1. Wearing course: III-D PG 64-10 per SPPWC Section 203-6.5.
   2. Base course: III-B2 PG 64-10 per SPPWC Section 203-6.5.

C. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.03 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 AGGREGATE BASE COURSE

A. See Section 321123.

3.03 PREPARATION - TACK COAT

A. Apply tack coat in accordance with SPPWC (Greenbook), Section 302-5.4.

B. Apply tack coat to existing pavement including planed surfaces, between hot mix asphalt layers, and to vertical surfaces of curbs, gutters, construction joints and milled pavements.

3.04 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install work in accordance with SPPWC (Greenbook) 302-5.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Place to a maximum thickness per SSPWC 302-5.

D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Install work in accordance with SPPWC (Greenbook) 302-5.

B. Place asphalt base course within 24 hours of applying primer or tack coat.

C. No pavement course shall be less than 1 1/2 inches in compacted thickness. If finish pavement thickness is 3 inches or less it shall be laid as single course.

D. No pavement course shall be more than 4 inches in compacted thickness.

E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.06 SEAL COAT

A. Apply seal coat to asphalt surface course and asphalt curbs in accordance with SPPWC (Greenbook) 203-9.

3.07 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch.

3.08 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for quality control.

B. Provide final surfaces of uniform texture, conforming to required grades and cross sections.
   1. Test in-place asphalt concrete courses for compliance with requirement for density, thickness, and surface smoothness.
      a. Density:
         1) Field test density of compacted asphalt surface course shall be determined by a properly calibrated nuclear test gage in accordance with ASTM D2950.
      b. Thickness:
         1) Thickness of compacted paving shall conform to ASTM D3549 based on core test.
         2) In-place compacted thicknessess shall conform to the dimensions indicated on the contract drawings. Variation from indicated thicknesses shall not exceed plus-or-minus 1/4-inch.

C. Flood Testing
   1. Flood Test: Before acceptance, all pavements in the presence of the project inspector shall be water tested to ensure proper drainage. The contractor shall provide water for this purpose. The flooding shall be conducted with a 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 1-hour after test.

3.09 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 321313
CONCRETE PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Driveways.
B. Roadways.
C. Parking lots.
D. Curbs and gutters.
E. Walks.
F. Stairs and ramps.
G. Mow strips.
H. Wheel stops.
I. Detectable warnings.

1.02 RELATED REQUIREMENTS

A. Divison 00 Section Available Project Information (Geotechnical Report)
B. Division 05 Section Metal Fabrications
C. Division 31 Section Grading
D. Division 32 Section Architectural Site Concrete
E. Division 32 Section Concrete Paving Joint Sealants

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: Fly ash and other pozzolans, and ground granulated blast-furnace slag, subject to compliance with requirements.

1.04 PREINSTALLATION CONFERENCE

A. Conduct conference at Project site two weeks prior to start of work of this section. Required attendance of all affected installers.
    1. Review methods and procedures related to concrete paving, including but not limited to, the following:
    2. Concrete mixture design
    3. Testing and inspection procedures.
    4. Concrete finishes and finishing.
    5. Cold- and hot-weather concreting procedures.
    6. Curing procedures.
    7. Construction joints.
    8. Forms and form-removal limitations.
    9. Reinforcement accessory installation.
    10. Concrete repair procedures.
    11. Protection of cast-in-place architectural site concrete.

12. Review special testing and inspection procedures.
13. Placement sequence and schedule.
14. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
    a. Contractor's superintendent.
    b. Ready-mix concrete manufacturer.
    c. Concrete paving subcontractor.
    d. District's or Client's Representative
    e. Architect's Representative
    f. Inspector of Record
    g. Provide meeting minutes for pre-installation conference

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Proprietary admixtures, pigments, curing compounds, hardeners, sealers, form-release agents, etc.: Indicate compatibility with other materials used.

B. Samples for Initial Selection: For each type of product, finish, ingredient, or admixture requiring color selection.
   1. Submit full range of manufacturer’s standard and custom range of colors and products for review and selection. Provide custom colors on samples as required. Upon selection of color, submit 12”x12” sample of material in the specified color finish for review by Landscape Architect in addition to the specified mock ups.
   2. Wheel Stops: 6 - 7 inches wide in cross section; with fasteners.
   3. Preformed Traffic-Calming Devices: 6 inches long showing cross section; with fasteners.

C. Design Mixtures: Submit proposed mix designs and test data for each class of concrete and for each method of placement.
   1. Prepare mix designs on the basis of field experience (preferred) and/or trial mixes, in compliance with California Building Code (CBC), Chapter 1903A.
   2. Mix designs shall be prepared, stamped and signed by a structural or civil engineer registered in the State of California.
      a. Mix designs shall be reviewed by the Architect (AOR) and Structural Engineer of Record (SEOR).
   3. Identify for each mix design submitted the method by which proportions have been selected.
      a. For mix designs based on trial mixtures, include trial mix proportions, test results, graphical analysis and show required average compressive strength f'c results. Provide gross weight and yield per cubic yard of trial mixes.
      b. Indicate quantity of each ingredient per cubic yard of concrete and percentages.
      c. Indicate type and quantity of admixtures proposed or required.
      d. Indicate water to cement ratio by weight.
      e. Measured slump.
      f. Measured air content.
      g. Provide shrinkage test results.
   4. Multiple mix designs or multiple manufacturers shall not be permitted for the same application.

D. Provide maximum 5% fly ash; ground granulated blast-furnace slag, and/or silica fume content as Portland cement replacement in all concrete.

E. Submit proposed alternate design mixtures for review by the Architect and SEOR when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

F. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Shop drawings should include details such as reveals, recessed lights, handrails, or other elements requiring steel coordination.
   1. Coordinate with and identify the details of the Contract Drawings on the shop drawings.
   2. Comply with ACI 315, part B and CRSI requirements.

G. Construction Joint Layout: Indicate proposed construction joints required to construct the structure. Submit dimensioned drawing indicating layout of construction joints, contraction (control) joints, dowelled joints, decorative scoring and placement sequence of concrete if different than layout indicated on plans.
   1. Location of construction joints are subject to approval of the Architect.
   2. All form seams are to align with construction joints or reveals.

H. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.

I. Qualification Data: For qualified ready-mix concrete manufacturer (batch plant) and installer of detectable warnings.

J. Welding Certificates: Submit certifications signed by AWS Certified Welding Inspector of prequalified welding procedures, qualifications of welding procedures unless prequalified, qualifications of welding operators and qualifications of welders.

K. Material Certificates: For the following, submit manufacturer data, test results, and technical information for aggregate, sand and cement, submit ½ cubic foot physical sample. For sealant submit manufacturer color standard and custom palette together with physical samples:
   1. Cementitious materials.
   2. Aggregates and sand.
   3. Steel reinforcement and reinforcement accessories.
   4. Admixtures.
   5. Curing compounds.
   6. Applied finish materials.
   7. Bonding agent and epoxy adhesives.
   8. Joint fillers.
   9. Sealer
   10. Sealant.

L. Material Test Reports: For each of the following:
   1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

M. Detectable Warning Device Warranty: Submit copies of manufacture's five year warranty for each of these products and manufacturer custom and standard color palette.

N. Field quality-control reports.
   1. Submit copies of delivery tickets complying with ASTM C 94 for each load of concrete delivered to the site. Tickets shall include all information required by the referenced standard.

O. Minutes of pre-installation conference.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with CBC Chapter 19A.
   1. Chemical products field-applied to concrete shall comply with the air quality requirements of authorities having jurisdiction.

2. Comply with requirements of local, State and other authorities having jurisdiction for work performed within public right-of ways.

B. Regulatory Requirements: Comply with CBC Chapter 19.

C. Chemical products field-applied to concrete shall comply with the air quality requirements of authorities having jurisdiction.

D. Comply with requirements of local, State and other authorities having jurisdiction for work performed within public right-of ways.

E. Industry Standards: Comply with the following unless modified by requirements in the Contract Documents.(Plans and specifications)
   1. ACI 301, "Specifications for Structural Concrete".
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".
   3. ACI 302.1R, "Guide for Concrete Floor and Slab Construction".
   4. ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete".
   5. ACI 305R, "Hot Weather Concreting".
   6. ACI 306.1, "Standard Specification for Cold Weather Concreting".
   7. ACI 318, "Building Code Requirements for Structural Concrete".
   8. ACI 347, "Guide to Formwork for Concrete".
   9. ACI SP-66, "ACI Detailing Manual".
   10. CRSI, "Manual of Standard Practice".
   11. CRSI, "Placing Reinforcing Bars".

F. Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of cast-in-place, surface-applied unit-paver-type detectable truncated dome products.

G. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

H. Source Limitations for Concrete Paving: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties. Secure all material required for the duration of the project as needed to ensure consistent quality in appearance.

I. Welding Qualifications: Comply with CBC Chapter 17A.
   1. Qualify welding procedures and welding personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel" prior to performing any welding.
   2. Qualify welding inspection personnel according to AWS QC1, "Standard for AWS Certification of Welding Inspectors."

J. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

K. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

L. ACI Publications: Comply with ACI 301 unless otherwise indicated.

M. Mockups: Before casting concrete paving, build mockups to verify selections made under Sample submittals and to fully demonstrate typical joints (including expansion and saw cut joints), surface finish, texture, color tolerances, standard of workmanship and completed product. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.

a. Paving Modules: Construct at least one 4 ft. x 4 ft. mockup of each color, finish, and mix design of special paving module, including stenciled areas, banding and curbs
b. Radial Paving Patterns: Construct at least one 180 sq. ft. mockup of curved or radial paving patterns.
c. Retarder Finishes: Mock ups shall clearly demonstrate an even finish. No blotchy or light areas.
d. Stairs: Construct minimum 2 risers and treads X 4' long with nosing grooves and stained color within groves for each color and finish specified.
e. Mow Strip: minimum 6' long for each specified width and color.

2. Build mockups full-size, matching site concrete components indicated on the Drawings. Mock-ups shall be complete in every detail, including joints, reveals, edges, chamfers, etc. Include complex joinery conditions where necessary to integrate to other Project components as indicated including multiple pour conditions. Mockups should be provided for each finish, color, joint and detail specified.
3. Maintain accurate records of variables associated with each mockup to facilitate the matching of accepted mockups during actual construction.
4. Demonstrate curing, cleaning, and protecting of cast-in-place concrete paving, finishes, and contraction and expansion joints, as applicable.
5. Mockup Acceptance: Obtain Architect's approval of mockups before casting architectural site concrete and paving.
   a. The Architect may reject mockups that, in the Architect's sole judgment, do not demonstrate an acceptable completed product, including, but not limited to, color, joint work, surface finish, texture, tolerances, and standard of workmanship
   b. The Architect may require modifications to mockups to obtain acceptable results.
   c. The Architect may require modifications to mockup repairs to obtain acceptable results.
   d. The Architect may require removal and reconstruction of mockups to obtain acceptable results. Multiple mock ups maybe required.
   e. Contractor shall provide additional mockups as required to obtain results acceptable to the Architect at no additional cost to the Owner.
6. Mockup Disposition: Accepted mockups shall not become part of the completed Project. Maintain mockup onsite for the duration of construction and until all work has been accepted. Remove and legally dispose mockups after acceptance of final installed work. prior to Project Completion. If sufficient permanent concrete paving work has been completed, Contractor may submit a written request to Architect to transfer quality control for concrete paving from the accepted mockups to one or more designated portions of the permanent work.
7. Provide written meeting minutes for each mock up review indicating items reviewed, approvals, rejections, connections, or other action items.

1.07 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending, damage, and rust.

1. Label bundles with durable identification tags. Maintain reinforcement identification after bundles are broken.
2. Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening contaminants.
3. Avoid damaging applied coatings, if any, on steel reinforcement.

PART 2 - PRODUCTS

2.01 FORMS

A. Formwork: / Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth surfaces.
   1. Set forms to alignment, grade and required dimensions. Formwork shall not deviate more than 1/4 inch from required vertical positions and 1/4 inch from required horizontal positions. Exposed Surfaces: Provide faced plywood panels complying with, or equivalent to, DOC PS 1, Structural I. Provide minimum 7-ply plywood and provide balance sheets for panels coated one-side only. Furnish in largest practicable sizes to minimize number of joints. Provide Medium-Density Overlay (MDO) panels or high density overlay (HDO) panels, with mill-applied release agent and edge sealant. Provide one of the following panels, or comparable substituted product:
      a. Olympic Panel Products, "B-Matte 333 MDO Concrete Form." Overlay Color: Brown.
      b. Pacific Laminate Products, "ProFace MDO." Overlay Color: Black.
      c. Sylvan Products, LLC, "Armor Ply MDO" Overlay Color: Brown.
   2. Hold forms rigidly in place by stakes, clamps, spreaders, and braces at 3 feet on centers, and where required to ensure rigidity.
   3. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.
   4. Place joint filler or backer rod on vertical surfaces in contact with concrete paving.
   5. Benders or thin plank forms may be used on curves, grade changes, or curb returns. Back forms for curb returns may be made of ½-inch thick benders cleated together for full depth of the curb.
   6. Keep forms in place until concrete is sufficiently hard to prevent damage to concrete.
   7. Reuse of Forms:
      a. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of surface or edge.
      b. Thoroughly clean and properly coat forms before reuse.
      c. Do not use forms from previous projects.
   8. Provide new forms specifically purchased for this project. Reuse of forms from past projects or contractors stock will not be accepted.

B. Curved Work: Kerf back of plywood form-facing panels, or use accepted flexible or curved forms for curved work with a radius of 100 feet or less.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.
   1. Obtain written acceptance of form release agent from integral colored concrete pigment manufacturer.
   2. Form-release agents shall be non-staining and can cause no visual effect to the finish.
   3. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

B. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
   1. Provide two-component "Speed Dowel System" manufactured by Greenstreak.

C. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

D. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

F. Zinc Repair Material: ASTM A 780.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, Type II, gray, unless white cement is required to achieve colors indicated.
      a. Fly Ash: ASTM C 618, Class F.

B. Normal-Weight Aggregates: ASTM C 33, complying with building code. Provide aggregates from a single source. All aggregates shall be free of materials with deleterious reactivity to alkali in cement when tested in accordance with ASTM C 289.
   1. Comply with CBC section 1903A.
   2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
      a. Source: Reliance, Vulcan, San Gabriel, or Carrol Canyon
      b. Hard rock mix; no pea gravel will be accepted.
   3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
      a. Source: Reliance, Foster, Corona
      b. Color to be white to light no dark material.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Shrinkage-Reducing Admixture: Commercially formulated, shrinkage inhibitor capable of reducing initial shrinkage by 80% and long-term shrinkage by 50%. Provide product suitable for use with either air-entrained or non-air-entrained concrete as appropriate to structural member and project location.
   1. Products: Subject to compliance with requirements, provide the following(as required):
      a. Meet ASTM C494 requirements
         1) Euclid Chemical Company (The), an RPM company; EUCON SRA, SRA+.
         2) Grace Construction Products, W. R. Grace & Co.; Eclipse Floor, Eclipse Plus.
         3) Sika Corporation; Control 40.

2.04 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete. Provide products with not more than 100g/L volatile organic content.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals, LLC; Confirm.
      b. Conspec by Dayton Superior; Aquafilm.
      c. Nox-Crete Products Group; MONOFILM.

E. Clear, Waterborne, Membrane-Forming Curing Compound (Colored Concrete): Provide products that are acceptable to concrete color pigment manufacturer complying with ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of sealers with no glossy finish and compatible with specified sealer. Provide products with not more than 100g/L volatile organic content.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sinak Corporation; The Cure WCE or Lithium Cure 1000.
      b. L. M. Scofield; Cureseal-W.
      c. Butterfield Color; Clear Guard H2O.

F. All curing materials should be dissipating without leaving a shiny, cloudy, or glossy finish. Curing material does not substitute requirement of a sealer.

2.05 HARDENERS AND SEALERS

A. Penetrating Liquid Floor and Horizontal Surface Treatment (Sealer): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate water-based lithium quartz materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. Materials hsall be compatible with concrete admixtures and shall be recommended by manufacturer for intended use. Provide product with 0g/L volatile organic content.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sinak Corporation; Concrete Sealer HLQ 125.
      b. L. M. Scofield; Cureseal-W.
      c. L&M Construction Chemicals, Inc.; Seal Hard.

2.06 RELATED MATERIALS

A. Joint Fillers:
   1. Ceramar by W.R. Meadows. A closed cell isomeric polymer synthetic foam ASTM D 5249, Type 2 .
   2. Deck-O-Foam polyethylene by W.R. Meadows. A closed cell expansion joint fille ASTM D 4819
   3. Asphalt-saturated cellulosic fiber in preformed strips, ASTM D 1751
   4. 1/4" thickness.

B. Bonding Agent: ASTM C 1059, Type II, non-re-emulsifiable. Provide proprietary products composed of latex polymers.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. W. R. Meadows, Inc.; “Acry-Lok”.
      b. Grace Construction Products, W. R. Grace & Co.; "Daraweld C".
      c. Larsen Products Corp., "Weld-Crete".

C. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of reveal specified.
   1. Provide W. R. Grace "Top-Cast".

2.07 DETECTABLE WARNING MATERIALS

A. General: All detectable warning systems shall comply with Americans with Disabilities Act (28 CFR Part 36 ADA Standards for Accessible Design, Appendix A, Section 4.29.2 Detectable Warnings on Walking Surfaces), and CBC requirements (Section 11B-24, 11B-705 and others). All detectable warning materials shall have raised truncated domes with a base diameter of nominal 0.90 inch (22.9 mm), tapering to a top diameter of 0.45 inch (11.4 mm),a height of nominal 0.20 inch (5.08 mm), and a center-to-center spacing of 2.35 inches (59.7 mm) nominal. The orientation of the dome pattern for all panels shall be parallel with the panel edges. Detectable warning materials shall visually contrast with surrounding areas.

1. California Compliance Warranty: All detectable warning systems shall be approved by DSA-AC. If not approved, DSA will accept a written five (5) year product warranty provided by the manufacturer of detectable warning products and directional surfaces. Such warranty shall indicate compliance with architectural standards as published in the current edition of the California Building Standards Code, and also include durability criteria which indicate that the shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly for at least five (5) years after initial installation. As defined by the State, "not degrade significantly" means that the product maintains at least 90 percent of its approved design characteristics, as determined by the enforcing agency.

2.08 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 3000 to 4000 -psi minimum compressive strength, 5-1/2 to 6 inches high by 6 to 7 inches wide by 48 inches long at singles stalls and 72 to 96 inches long at shared stalls. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

1. Dowels: Galvanized steel or rebar, 1/2 inch in diameter, 18-inch minimum length.

2.09 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. Proportioning:
   a. The proportioning of ingredients shall be such that the concrete can be readily worked into forms and around reinforcement under the conditions of placement to be used, without segregation or excessive bleeding.
   b. When proportioning by weight of loose, dry material, 94 pounds of cement shall be considered 1 cubic foot.
      1) Float/Broom Finish: Coarse aggregate 50 percent-50 percent fine aggregate.
      2) Retarder finish: Coarse aggregate 40 percent, fine aggregate 60 percent.
   c. Total water content shall not exceed 35 gallons per cubic yard of concrete.
   d. Weighing equipment shall be accurate within 1 pound and shall be adjustable for varying aggregate moisture content.
   e. A beam auxiliary shall register any part of the last 100 pounds of each aggregate. The aggregate hopper shall have a volume adjustment.
3. Prepare compressive strength data for both 7-day and 28-day strengths.
   a. The 7-day compressive strength shall be at least 60 percent of the required 28- day strength.
   b. The 28-day compressive strength shall be as indicated.
   c. Provide drying shrinkage test data at 28 days, from not less than 3 test specimens.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Typical Compressive Strength (28 Days): Provide the following minimum compressive strength (28 days) for concrete paving unless otherwise indicated: 3000 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50-0.60.
   3. Slump Limit: 4 inches, plus or minus 1 inch, unless indicated otherwise.
      a. Slump Limit (High-Range Water-reducing Admixture): 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture, plus or minus 1 inch, unless indicated otherwise.

C. Air Content, Exterior Exposed Concrete: Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having the following air entrainment for all exposed concrete with a weathering probability of severe or moderate per ACI-318-19, ACI 305R, and ACI 306R.
   1. Provide air entrainment of 6.0 percent, plus or minus 1.5 percent at point of delivery for 1-inch and 3/4-inch nominal maximum aggregate size, if required unless indicated otherwise.

D. Limit "drying shrinkage" after 28 days of curing hardened concrete to 0.045 percent of the original concrete volume.

E. Limit water-soluble, chloride-ion content in hardened concrete to [0.15] [0.30] [1.00] percent by weight of cement.

F. Chemical Admixtures: Admixtures may only be used if they are incorporated into the accepted concrete mix designs. Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   2. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   3. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

G. Liquid Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with accepted mockup.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M [or ASTM C 1116/C 1116M when fiber reinforcement is used]. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 and 90 deg. F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg. F (32 deg. C), reduce mixing and delivery time to 60 minutes.

B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Grading."

C. Proceed with concrete paving installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

C. Slope stair and step treads at not less than 1.0 percent and not more than 2.0 percent cross slope to drain.

3.04 STEEL REINFORCEMENT

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation or expansion joint, and saw cut / contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Isolation (Expansion) Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 20 feet maximum unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint and recess 1 inch from finish surface where no joint sealant is indicated.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   5. Break steel at expansion joints.
   6. Dowels- provide prefabricated ‘speed dowel’ assemblies.

C. Saw Cut (Control) Joints: Form weakened-plane saw cut joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth plus 1/4 inch of the concrete thickness, as follows, and to match jointing of existing adjacent concrete paving:
   1. Continue steel reinforcement across sawcut joints unless otherwise indicated.

D. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/8-inch radius unless otherwise noted. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in. Notify other trades as necessary to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, and side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
   1. When air temperature has fallen to or is expected to fall below 40 deg. F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg. F (10 deg C) and not more than 80 deg. F (27 deg C) at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 305R (ACI 305R M) and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg. F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

N. Provide sand and base materials as indicated.

3.07 **FLOAT/BROOM FINISHING**

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
   2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture. Required to meet slip coefficient requirement.
   3. Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with **CBCSections 11B-302** and **11B-403**.

3.08 **RETARDER FINISHING(FINE AGGREGATE)**

A. Protect all surrounds from overspray of liquid materials, including, but not limited to, adjacent horizontal surfaces, windows, roofs, walkways, drives, and landscaping.
   1. Apply surface protectant and /or plastic sheeting, sufficently taped in place.

B. Ensure to screed surface of concrete evenly to designated slope shown on approved civil grading plans.

C. Prepare concrete for retarder finish as recommended by retarder manufacturer.
   1. Consider using rolling tamper, jitterbug or rolling jitterbug to create a denser surface paste with no obstruction due to the appearance of course aggregate, allowing for a uniform sand texture.
   2. Screed or strike off the surface in two (2) directions using a wooden or metal straight edge to achieve the proper elevation in a sawing motion back and forth.
   3. Allow the bleed water to evaporate from the surface.
   4. Float concrete using a wooden hand/bull float.
   5. Float to a uniform appearance.
   6. Hand trowel or Fresno steel frowel to create tight dense smooth surface.(This could require 2 - 3 passes depending on mix design and/or desired finish to be achieved)
   7. Do not burnish the surface or allow the exposed sand surface to premanturely dry prior to the application of the surface retarder.

D. Mix surface retarder thoroughly prior to each use.

E. Apply surface retarder per manufacturers recommendations.

F. Remove retarder per manufactures recommendations.

3.09 DETECTABLE WARNINGS

A. Detectable Warnings, General: Install detectable warnings as part of the concrete paving placement sequence. Set true to line and elevation. Comply with maximum slope and cross-slope requirements for accessible walkways.
   1. Blockouts: Form blockouts in concrete and asphalt pavements for installation of detectable paving units.
      a. Tolerance for Opening Size: Plus 1/4 inch, no minus.

B. Detectable warnings surfaces shall comply with **CBC Section 11B-705.1.**

C. 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 contrast 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.**

D. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. **CBC Section 11B-705.1.1.4.**

E. Provide 5 year minimum warranty per **DSA Bulletin 10/31/02, revised 04/09/08.**

F. Precast Concrete Detectable Warning Tiles: Comply with approved plans and details along with manufacturer's written instructions.

G. Cast-in-Place Detectable Warning Panel: Comply with manufacturer's written instructions.

3.10 CONCRETE PROTECTION, CURING AND SEALING:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306R for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

F. Seal Concrete: Apply specified sealer in accordance with manufacturer’s recommendations.
   1. Apply full strength in two coats with airless sprayer at the manufacturer’s recommended rate.
   2. After the first coat is completely dry, apply second coat at right angles to the first coat.

3.11 PAVING TOLERANCES

A. Comply with tolerances in ACI 117, the Americans with Disabilities Act, the CBC and as follows:
   1. Elevation: 1/8 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/8 inch. Surface must properly drain.
   4. Surface Discontinuities: Maximum 1/4 inch, subject to further limitations of accessible routes.
   5. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   6. Lateral Alignment and Spacing of Dowels: 1/4 inch.
   7. Vertical Alignment of Dowels: 1/8 inch.
   8. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/8 inch per 12 inches of dowel.
   9. Joint Spacing: 3 inches, except joint position shall be within 1/4 inch of objects in alignment with joint such as benches, light poles, pull boxes, etc.
   10. Sawcut Joint Depth: Plus 1/4 inch, no minus.
   11. Joint Width: Plus 1/16 inch, no minus.

B. Stair Treads: Stair treads within a run shall be constructed equally and shall shed water away from the path of travel. Maximum tread slope down from riser to nosing in direction of travel: 1.0 percent, plus or minus 0.5 percent. Maximum tread cross-slope perpendicular to direction of travel: 1.8 percent, plus 0.2 percent, minus 1.0 percent or as required to shed water.

C. Ramps: Ramps shall shed water away from the path of travel. Maximum ramp slope in direction of travel: 8.33 percent. Maximum ramp cross-slope perpendicular to direction of travel: 1.8 percent, plus 0.2 percent, minus 1.0 percent or as required to shed water.

3.12 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils. Provide markings with a minimum width of 3 inches.
   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
   2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb./gal.

E. Accessible parking spaces serving a particular building or facility shall be located, and dispersed if serving more than one accessible entrance, on the shortest accessible routes to an entrance or to mulitple accessible entrances. **CBC Section 11B-208.3.1.**

F. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. **CBC Section 11B-208.3.1.**

G. Minimum number of required accessible parkng spaces shall be provided in accordance with **CBC Table 11B-208.2** for each parking facility provided.

H. For every six or fraction of six accessible parking spaces, at least one shall be an accessible van parking space. **CBC Section 11B-208.3.1.**

I. Accessible parking spaces and access aisles shall comply with **CBC Section 11B-502** and shall be dimensioned to the cenerlines of the marked lines as follows:
   1. Parking spaces and access aisles shall be mareked according to **CBC figures 11B-502.2, 11B-502.3, and 11B-502.3.3**. Their surfaces shall comply with **CBC Section 11B-302** and shall be at the same level with the slopes not steeper than 1:48 in any direction. **CBC Section 11B-502.4.**
   2. Parking spaces shall be 9'x18' minimum and van parking spaces shall be 12'x18' minimum with an adjacent access aisle of 5'x18' minimum. Access aisles shall be placed on either side of the parking spaces except be located on the passenger side for van parking spaces. Van parking spaces shall be permitted to be 9'x18' minimum where the access aisle is 8'x18' minimum.
   3. Access aisles shall be marked by a blue painted borderline around their perimeter. The areas within the blue borderlines shall be mareked with hatched lines a maxiumum 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 requied length. **CBC Section 11B-502.3.3**
   4. Access aisles(parking spaces as well- similar application) shall not overlap the vehicular way. **CBC Section 11B-502.3.4**
   5. A verticle clearance of 8'-2" minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. **CBC Section 11B-502.5**

J. At least one passenger loading zone shall be provided in every continuous 100 linear feet of loading zone space, or fraction thereof, complying with **CBC Section 11B-209 and 11B-503** as follows:
   1. Vehicle pull-up spaces shall be 8' x 20' minimum. Access aisles shall be 5' x 20' minimum and shall be adjacent and parallel to the vehicular pull-up spaces. They shall be the same level with slopes not steeper than 1:48 in any direction. **CBC Section 11B-503.4.**
   2. Access aisles for passenger drop-off and loading zones shall be marked with a painted borderlines around their perimeter. The areas within the borderlines shall be marked with hatched lines a maxiumum of 36" on center in a color contrasting with that of the aisle surface. **CBC Section 11B-503.3.**
   3. A vertical clearance of 9'-6" minimum shall be provided for vehicle pull-up spaces, access aisles, and a vehicular route serving them connecting a vehicular entrance and a vehicular exit. **CBC Section 11B-503.5.**

3.13 WHEEL STOPS

A. Securely attach wheel stops to paving with not less than two #4 galvanized steel dowels or rebar, minimum 18 inches long, located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 20 cu. Yd., or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg. F and below and when it is 80 deg. F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Owner, Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements. Concrete paving will be considered defective if it does not pass tests and inspections.

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

I. Prepare test and inspection reports.

3.15 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, cracked, chipped, stained or defective or that does not comply with requirements in this Section as determined by Landscape Architect. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude all but pedestrian traffic from paving for at least 28 days after placement. When construction traffic is permitted, maintain paving as clean as possible by providing adequate surface protection and by removing surface stains and spillage of materials as they occur.
    1. Rubber tire marks are unacceptable in the completed construction.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Project Completion inspections.

E. Repair of damaged, defective or rejected concrete is not permitted. Remove all concrete from expansion joint to expansion joint or greater as required to provide a constant continuous finish.

3.16 FINAL CLEANING

A. Remove all excess concrete, form materials, over pours, waste, etc., and legally dispose off-site.

B. Provide a final acid and power wash for all concrete paving surfaces. Do not use any material that will affect the appearance of the concrete.

C. All over pours in planting areas should be removed prior to landscape operations.

D. Clean concrete paving to remove stains, markings, dust, and debris.

END OF SECTION

SECTION 321373
PAVEMENT JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES: RELATED DOCUMENTS

A. Exterior joint sealant for non-traffic surfaces.

1.02 RELATED REQUIREMENTS

A. Division 32 Section Concrete Paving.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-), and 1/4-inch (6.4-mm) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

D. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

B. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

C. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

D. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

E. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

F. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

B. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).

C. When joint substrates are wet or covered with frost.

D. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

E. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Landscape Architect from manufacturer's full range.

2.03 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Multicomponent Pourable Urethane Sealant (Sealant #1):
   1. Available Products:
      a. Pecora Corporation; Urexpan NR-200.
      b. Sika Corporation, Inc.; Sikaflex - 2c SL.
   2. Type and Grade: M (multicomponent) and P (pourable).
   3. Class: 25.
   4. Use Related to Exposure: T (traffic).
   5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

D. Multicomponent Nonsag Urethane (Sealant #2):
   1. Available Products:
      a. Pecora Corporation; Dynatred.
      b. Sika Corporation, Inc.; Sikaflex - 2c NS
   2. Type and Grade: M (multicomponent) and NS (nonsag).
   3. Class: 25.
   4. Use Related to Exposure: T (traffic).

5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

2.04 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.05 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

F. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

3.06 SCHEDULE

A. Horizontal Joints, less than 5 percent slope; Sealant No. 1.

B. Horizontal Joints, grades steeper than 5 percent; Sealant No. 2

C. Vertical Joints; Sealant No. 2

END OF SECTION

SECTION 321440
STONE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Paver materials.

B. Mortar and grout materials.

C. Accessories.

D. Mixes.

1.02 RELATED REQUIREMENTS

A. Section 312200 - Grading: Preparation of subsoil for pavers.

1.03 REFERENCE STANDARDS

A. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2025.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

C. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.05 MOCK-UP

A. Provide paver mock-up, 4 feet long by 4 feet wide; include setting bed, pavers, joints, and edging.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.06 FIELD CONDITIONS

A. Maintain cementitious materials and substrate surface to a minimum of 50 degrees F prior to, during, and 48 hours after completion of work.

B. At end of working day or during rainy weather, cover work exposed to weather with waterproof coverings, securely anchored.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagstone Pavers:
   1. Bourget Brothers: 310.450.6556 x 221.

2.02 PAVER MATERIALS

A. Flagstone Pavers: Split units with sawn backs; Various size, 1 inch thick; various shape; Arizona Chocolate color.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M Type I, gray color.

B. Sand: ASTM C144; sharp, clean, screened sand free of injurious amounts of organic material.

C. Premixed Grout Mortar: _____. Provide VBM manufactured by Orco Block .

D. Water: Potable, not detrimental to mix.

2.04 ACCESSORIES

A. Sealant: ASTM C920, self-leveling or nonsag polyurethane or silyl-terminated polyether/polyurethane (STPE/STPU) sealant explicitly approved by manufacturer for traffic exposure without being recessed below the top of substrate surface.

2.05 MIXES

A. Mortar Bed: ASTM C270, Type S, using the Proportion Specification.

B. Joint Grout: Portland cement mix conforming to the following:
   1. Compressive Strength (28 day): 3000 psi.
   2. Slump: 1 to 2 inches.
   3. Air Entrainment: 3-5 percent.

C. Add admixtures in accordance with manufacturer's instructions.

D. Thoroughly mix ingredients in quantities needed for immediate use.

E. Use within two hours after mixing. Do not re-temper.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is smooth, capable of supporting pavers and imposed loads, and ready to receive work of this section.

B. Verify gradients and elevations of substrate are correct.

3.02 INSTALLATION - MORTAR SETTING BED

A. Set paver units in full mortar bed of minimum 1 inch thickness, to support pavers over full bearing surface.

B. Place paver units in herringbone pattern, from straight reference edge.

C. Maintain uniform joint width of 3/8 inch between pavers, and at abutting vertical surfaces and protrusions. To accommodate grout, rake out joints 1/4 to 3/8 inch deep.

D. Fill joints with grout; pack and work into voids; neatly tool surface to concave joint. Wet cure.

3.03 CLEANING

A. Do not clean pavers until pavers and mortar are dry.

B. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.

C. Use non-metallic tools in cleaning operations.

D. Rinse surfaces with clean water.

3.04 PROTECTION

A. Do not permit traffic over unprotected paver surface.

B. Protect paver surface with sheets of plywood.

3.05 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 321500
DECOMPOSED GRANITE SURFACING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aggregate paving surface course (resin-stabilized decomposed granite).
B. Edging materials

1.02 RELATED REQUIREMENTS

A. Division 31 Section Grading
B. Division 32 Section Asphalt Paving
C. Division 32 Section Landscape Work

1.03 DEFINITIONS

A. Decomposed Granite (DG): compacted decomposed granite composite utilizing resin emulsion and specified aggregate.
B. Resin emulsion: Liquid binding agent for Decomposed Granite (DG).

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Manufacturer's product sheets, including installation specifications.
B. Samples for Verification: For each of the following:
   1. Decomposed granite or specified aggregate: 2 lb. sample of each color and texture of stone required, in labeled plastic bags.
   2. One foot length of edging materials and accessories, of manufacturer's standard size, to verify color selected.
   3. 12-inch by 12-inch filter fabric (soil separator) membrane.
C. Test reports:
   1. Marshall Stability test results using pre-approved specified aggregate.
   2. Final compaction report.
D. Mix Design:
   1. Source, color and weight of aggregate.
   2. Quantity of water for pre-wetting.
   3. Quantity of resin emulsion.
   4. Written certification from approved mix manufacturer that all deliveries of mix meet specifications.
   5. Weight tickets or weigh-master tickets for each load of mix.

1.05 QUALITY ASSURANCE

A. Pre-installation Meeting:
   1. The Contractor shall coordinate, schedule and conduct a meeting to review the installation requirements with the mix supplier and Architect.

B. Mockup:
   1. Contractor shall form and install a 4-foot square sample of DG duplicating a small section of actual work to be done for each type, size and color of surfacing material.
   2. If work is acceptable, sample may be part of the total production. If work is not satisfactory, sample shall be removed at Contractor's expense and further samples installed until approved as satisfactory by Architect.

C. Installer Qualifications: Installer to provide evidence to indicate successful experience in providing decomposed granite or crushed 3/8" or 1/4" minus aggregate paving containing stabilizer binder additive.
   1. Installer shall be a certified by the manufacturer or blender of the resin product.

1.06 SITE CONDITIONS

A. Weather and site requirements:
   1. Aggregate base or sub-base is to be dry.
   2. Do not install DG mix, or apply seal coat if the possibility of rain is forecast within four days following installation.
   3. Resin emulsion is diluted with water: protect newly installed pavement and seal coat from water until curing is complete.
   4. Install DG mix and seal coat when ambient temperature is above 60 degrees Fahrenheit and overnight temperature is above 32 degrees F.

1.07 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Warranty Period: Contractor shall provide warranty for performance of product. Contractor shall warranty installation of product for the time of one year from completion.

C. Contractor shall provide, for a period of sixty days, unconditional maintenance and repairs as required.

1.08 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Aggregate: Furnish one five pound bag for each type, color, and size of material installed.
   2. Resin emulsion: Furnish one 40 pound bag of stabilizer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for 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, the manufacturers specified.

2.02 AGGREGATE MATERIALS

A. Suppliers: Subject to compliance with requirements, provide material to be incorporated into the Work, but are not limited to, the following suppliers:
   1. Gail Materials, Corona, CA.
   2. KRC Rock, San Marcos, CA.
   3. TMT Enterprises, San Jose, CA 408-432-9040.
   4. LH Voss Materials, Dublin, CA 925-560-9920.
   5. Silverado, Sacramento, CA 916-361-7374.

B. Nominal maximum size of aggregate:
   1. Sieve Metric% Passing
   2. 9.5 mm 95 -100
   3. 4.5 mm 87 -100
   4. 2.36 mm 73 - 93
   5. 600 um 34 - 54
   6. 300 um 20 - 40
   7. 75 um min 11 - 23

2.03 STABILIZING AGENT

A. Basis of Design: Design is based on "Stabilizer" manufactured by Stabilizer Solutions, Inc. 205 South 28th St., Phoenix, AZ 85034; phone (602) 225-5900, (800) 336-2468; fax (602) 225-5902; website stabilizersolutions.com; or a comparable product by one of the following:
   1. Stabilizer Solutions, Phoenix, AZ (800) 336-2468
   2. Soil Stabilization Product Company, Inc. Merced, CA (800) 523-9992
   3. SoilTac by Soil Works, Inc. CA (760) 345-0771

B. Basis of Design: Design is based on "NexPave System" with Organic Lok binder, available through Gail Materials: Contact Dave Dzwilewski; phone (951) 667-6106

C. Resin emulsion: Totally natural additive emulsion with high solids content formulated especially for use as a natural flexible pavement binder.
   1. Resin-stabilized DG shall cure to a water-insoluble, high strengths state, equal in strength to hot-mix asphalt concrete.
   2. Resin emulsion shall dry without affecting the color of the aggregate.
   3. Resin emulsion shall be added at an addition rate of 10%-12% during blending operations.
   4. Resin emulsion shall be non-hazardous, non-toxic, non-corrosive, and shall be water-soluble.

D. Water: Fresh, clean, and potable.

E. Seal coat: Resin emulsion.

F. Tack coat: Resin emulsion diluted with water.

2.04 DECOMPOSED GRANITE MIX (DG MIX)

A. Basis of Design: XXXXXX

B. DG mix as supplied by manufacturer-approved blender with not less than 10% - 12% emulsion by dry weight of the aggregate.

C. Blend 12 to 16 lbs. (verify with manufacturer for exact blend) of Stabilizer per 1-ton of decomposed granite or crushed 3/8" or ¼" minus aggregate screenings. It is critical that stabilizer be thoroughly and uniformly mixed throughout decomposed granite or crushed ¼" or 3/8" minus aggregate screenings.

D. Installed DG mixture shall meet the following requirements when tested in accordance with the Marshall Stability Test, ASTM D 1599-89. Mix blending facility shall submit test results for review and approval. Requirements for Marshall Stability Flow: Stability Minimum (pounds) shall equal 4,000 lbs.

2.05 EDGING

A. Basis-of-Design Product: Subject to compliance with requirements, provide PermaStrip, manufactured by PermaLoc Corporation, Holland, MI (800) 356-9660, www.permaloc.com .

B. Aluminum edging: 3/16" x 5 ½", manufactured from 6063 extruded aluminum alloy of T-6 hardness with interlock system and 5 stake punch outs fabricated in each strip. Stakes 1/5" x 12" lock 1/2" below top of edging.
   1. Thickness: 1/8 inch (3.2 mm) gage section at 0.072 inch (1.83 mm) minimum thick with 0.135 inch (3.4 mm) exposed top lip and 3/16 inch (4.8 mm) gage section at 0.116 inch (2.95 mm) minimum thick with 0.187 inch (4.75 mm) exposed top lip.
   2. Length: 16 feet (4.88 meters). Selected products in 8 foot (2.44 meters) sections.
   3. Connection Method: Section ends shall splice together with an interlocking stakeless snap-down design
   4. Finish: Black Anodized

2.06 WEED BARRIER FABRIC

A. Basis-of-Design Product: Subject to compliance with requirements, provide Mirafi N-Series, Model 140N manufactured by Mirafi, Pendergrass, GA (706) 693 2226, www.mirafi.com.

B. Spun or woven, non-degrading geotextile fabric that blocks 95% of weed growth and is permeable to air, water, gases and fertilizer.
   1. Filter Fabric: Composite fabric geotextile consisting of woven, needle-punched polypropylene geotextile substrate bonded to a non-woven polypropylene fabric, weighing not less than 4.8 oz./sq. yd. (160 g/sq. m).

2.07 SOIL STERILANT

A. Soil Sterilant: Oxycil Ureabor, as manufactured by Best Products Division, Occidental Chemical Company, Lathop, CA.

2.08 HERBICIDE

A. Chemical herbicide shall be Surflan or Dacthol pre-emergent. All material shall have an integral dye so that it is evident which areas have been treated. It is the Contractor's responsibility to post warnings to indicate that the above chemicals are being applied.
   1. Chemical herbicide for control of actively growing weeds and grasses shall be Roundup or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine site and verify that conditions are suitable to receive work and that no defects or errors are present which would cause defective installation of product or cause latent defects in workmanship and function.

B. Review subgrade to verify that it has been graded correctly and compacted as required for installation of the decomposed granite.

C. Before proceeding with work, Contractor shall notify the Architect in writing of any unsuitable conditions and conflicts.

3.02 PROTECTION OF EXISTING CONDITIONS

A. Use every possible precaution to prevent damage, including staining, to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the work.

B. Provide barricades, fences or other barriers as necessary to protect existing conditions to remain from damage during construction.

C. Contractor is fully responsible for all costs associated with replacement of damage caused by his work.

3.03 LAYOUT

A. Establish lines and levels, locate and lay out by instrumentation and similar appropriate means for aggregate paving finish grades.

B. Staking: Provide a sufficient quantity of grade stakes as required to provide aggregate paving with smooth finish grades and positive drainage.

3.04 SUB-GRADE PREPARATION

A. Refer to Geotechnical report for subgrade preparation prior to placement of decomposed granite. Grade subgrade with uniform slope between points where elevations are given.

B. Subgrade shall be crowned in the middle, or have a 2% slope from one side to the other.

C. Grade sub-grade surface to within 0.05 foot of finish grade minus aggregate paving thickness.

D. Fill and compact any depressions and remove loose material to finish true to line and grade, presenting a smooth, compacted and unyielding surface.

E. Remove debris, loose dirt and other extraneous materials.

F. Ditches, drains and drain pipes shall be installed if necessary to protect of the pavement and base from cross flows of water. All water flow should be directed off of and away from the pavement and base.

3.05 AGGREGATE BASE

A. Edging materials must be in place prior to placing aggregate base or DG. The DG compacted surface should be no less than 1/8" above the edging material to assure proper drainage

B. Place and compact aggregate base and provide finished surface per Division 32 Asphalt Paving specification.

C. Compaction tests of aggregate base are required prior to installation of DG.
   1. Architect shall to determine how many compaction tests are to be conducted.
   2. Aggregate base must not be disturbed during installation of DG.
   3. Any damage to base during testing must be repaired prior to placement of pavement.

3.06 INSTALLATION OF DG MIX

A. Edging materials must be in place prior to placing DG. The DG compacted surface should be no less than 1/8" above the edging material to assure proper drainage.

B. Install weed barrier fabric over compacted subgrade prior to installation of DG mix. Minimum thickness shall be XX".

C. Decomposed Granite (DG) to be installed in 2-inch nominal lifts to the desired overall thickness.

D. Placement: Place mix via a single, continuous operation.
   1. Use a self-propelled, mechanized spreading-and-finishing machine designed specifically for placement of resin emulsion mix.
   2. Machine shall be equipped with a screen or strike-off assembly capable of being accurately regulated and adjusted to a uniform depth.
   3. Small amounts of material may be placed and raked by hand, using asphalt rakes.

E. Provide a structural section of a minimum of XX" compacted thickness upon completion of final compaction. Verify required thickness on drawings.

F. DG surface shall be crowned in the middle or have a 2% cross slope, unless finish graded on the drawings.

G. If slope of surfaces to be paved exceed 4 percent, place material in an uphill direction. Do not allow placing equipment to run over un-compacted material.

H. Initial compaction: After mix placement, begin initial compaction as soon as mix will bear roller weight without undue displacement.
   1. If mix will not support compaction equipment due to excess moisture, delay initial compaction until mix achieves adequate stability to support compaction equipment.
   2. Use of non-heeled boots is required for anyone having to walk on resin DG during installation process.
   3. Perform initial breakdown compaction with self-propelled, 1-ton steel drum rollers in static mode only. Walk-behind vibratory plate compactors shall be used for edges and areas where a steel drum roller is not practical.
   4. On grades of 4% or steeper: Use static rollers, operate equipment at slow speeds and with the drive wheel forward to the uphill direction of work progress.
   5. Generally, no more than two passes are required for initial compaction.
   6. Warning: If the pavement begins to develop stress cracks, the pavement is being over-compacted and further compaction should be halted.
   7. Test paving surface for slope and smoothness after initial rolling, and correct deficiencies immediately so that finished surface will meet specified tolerances and requirements for smoothness.

I. Final Compaction:
   1. Begin final compaction as soon as possible after initial compaction has been completed.
   2. The purpose of the final compaction is to eliminate roller marks from the initial compaction and to create an aesthetically appealing pavement surface. The Architect shall be the judge of aesthetic considerations.
   3. Contractor may use a 1-ton steel drum roller or small plate compactor. Do not over roll.

3.07 TOLERANCES

A. In-Place compacted thickness:
   1. Compacted Sub-Grade Course: Maximum 1/2-inch plus, minus 0-inch.
   2. Aggregate Paving Surface Course: Maximum 3/16-inch plus, minus 0-inch.

B. Finished surface smoothness:
   1. Subgrade: +/- 0.08 foot.
   2. Compacted Sub-Grade Course: Maximum 3/8-inch in 10-feet.
   3. Aggregate Paving Surface Course: Maximum 3/16-inch in 10-feet in any direction.

3.08 REPLACEMENT OF DEFECTIVE PAVEMENT

A. Replace full depth of paving thickness in paving mixes that are contaminated, pavement that is cracked, or otherwise defective.
   1. Skin patching will not be permitted.

B. Edges of Replaced Pavement:
   1. Cut edges of pavement to be removed so that sides are vertical and oriented perpendicular and parallel to direction of traffic.
   2. Spray edges with a tack coat of resin emulsion.

C. Installation of replacement pavement:
   1. After applying tack coat, place pavement mix in areas where paving was removed in sufficient quantity to conform to elevation and tolerance requirements.
   2. Thoroughly compact DG mix so that cured patch meets all requirements set forth in this specification.
   3. Skin patching of an area that has been rolled will not be permitted.

3.09 FIELD QUALITY CONTROL

A. Density tests:
   1. Perform tests in accordance with ASTM D 2950.
   2. Perform tests within 48 hours after final compaction.
   3. Perform at least three tests, in areas specified by Architect.

B. Surface shall not vary more than 3/16 inch per 10 feet, except at intersections or changes of grade. Areas not meeting specified surface tolerance are to be corrected immediately after initial compaction.

C. DG course thickness: Correct areas not meeting specifications immediately after initial compaction.

D. Ground surfaces onaccessible routes, clear floor or ground spaces, and turning spaces for play areas shall comply with **CBC Section 11B-1008.2.6** as follows:
   1. Ground surfaces shall be inspected and maintained regularly and frequently to ensure continued compliance with **ASTM F 1951.**
   2. Ground surfaces located within use zones shall comply with **ASTM F 1292.**

3.10 PROTECTION

A. Protect pavement surface against equipment and traffic until pavement has cured sufficiently, a minimum of 72 hours, to support traffic without marring, rutting, tearing, distressing or damaging the pavement in any way. Utilize warning signs, barricades, and protection fencing to protect pavement from traffic.

B. All pavement installed must be protected by covering with plastic sheeting if unforeseen inclement weather occurs prior to complete curing.

C. Contractor is responsible for replacing damaged pavement, if damage was preventable, at his own expense.

3.11 CLEANING

A. Keep DG mix off of adjacent surfaces, including planting areas and pavements.

END OF SECTION

SECTION 321713
PARKING BUMPERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast concrete parking bumpers and anchorage.

1.02 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2025.

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

C. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

D. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.

E. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2023.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide unit configuration, dimensions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Parking Bumpers: Precast concrete, complying with the following:
   1. Nominal Size: ____ inches high, ____ inches wide, ____ feet long.
   2. Cement: ASTM C150/C150M, Portland Type I - Normal; gray color.
   3. Concrete Materials: ASTM C330/C330M aggregate, water, and sand.
   4. Reinforcing Steel: ASTM A615/A615M, deformed steel bars; unfinished, strength and size commensurate with precast unit design.
   5. Air Entrainment Admixture: ASTM C260/C260M.
   6. Concrete Mix: Minimum ____ psi compressive strength after 28 days, air entrained to _____ percent.
   7. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
   8. Embed reinforcing steel, and drill or sleeve for two dowels.
   9. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
   10. Minor patching in plant is acceptable, providing appearance of units is not impaired.

B. Dowels: Steel, unfinished; 1/2 inch diameter, ____ inch long, pointed tip.

C. Dowels: Cut reinforcing steel, 1/2 inch diameter, ____ inch long, pointed tip.

D. Dowels: As indicated on drawings.

E. Adhesive: Epoxy type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units without damage to shape or finish. Replace or repair damaged units.
B. Install units in alignment with adjacent work.
C. Fasten units in place with 2 dowels per unit.

END OF SECTION

SECTION 321723
PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Parking lot markings, including parking bays, crosswalks, arrows, isa symbols, and curb markings.

1.02 RELATED REQUIREMENTS

A. Section 321216 - Asphalt Paving.

B. Section 321313 - Concrete Paving.

1.03 REFERENCE STANDARDS

A. AASHTO MP 24 - Standard Specification for Waterborne White and Yellow Traffic Paints; 2015 (Reapproved 2020).

B. California MUTCD - Manual of Uniform Traffic Control Devices for Streets and Highways; State of California Department of Transportation (FHWA's MUTCD as amended for use in California); current edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Certificates: Submit for each batch stating compliance with specified requirements.
   1. Painted pavement markings.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.

1.08 SEQUENCING

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of markings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Painted Pavement Markings:
   1. Dunn-Edwards Corporation; Vin-L-Stripe Specialty Interior/Exterior Flat Zone Marking Paint.
   2. Sherwin Williams: Setfast Acrylic Traffic Paint.
   3. Pervo Paint Company: Acrylic Traffic Paint.
   4. Vista Paint Corporation: Traffic Paint.
   5. Equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify existing markings for removal.

B. Verification of Conditions: Verify that pavement is dry and ready for installation.

C. Notify Architect of unsatisfactory conditions before proceeding.

3.02 PREPARATION

A. Establish survey control points for locating and dimensioning of markings.

B. Place barricades, warning signs, and flags as necessary to alert approaching traffic.

C. Clean surfaces prior to installation.
   1. Remove dust, dirt, and other debris.
   2. Remove rubber deposits, existing paint markings, and other coatings.

D. Temporary Markings: Apply as directed by Architect.

E. Apply paint stencils by type and color at necessary intervals.

3.03 REQUIREMENTS

A. Accessible parking spaces serving a particular building or facility shall be located, and dispersed if serving more than one accessible entrance, on the shortest accessible routes to an entrance or to multiple accessible entrances. CBC Section 11B-208.3.1

B. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. CBC Section 11B-208.3.1

C. Minimum number of required accessible parking spaces shall be provided in accordance with CBC Table 11B-208.2 for each parking facility provided.

D. For every six or fraction of six accessible parking spaces, at least one shall be an accessible van parking space. CBC Section 11B-208.2.4

E. Accessible parking spaces and access aisles shall comply with CBC Section 11B-502 and shall be dimensioned to the centerline of the marked lines as follows:

1. Parking spaces and access aisles shall be marked according to CBC Section 11B-502.2 , CBC Section 11B-502.3, and CBC Section 11B-502.3.3. Their surfaces shall comply with CBC Section 11B-302 and shall be at the same level with slopes not steeper than 1:48 in any direction. CBC Section 11B-502.4 .
2. Parking spaces shall be 9' x 18' minimum and van parking spaces shall be 12' x 18' (CA) minimum with an adjacent access aisle of 5' x 18' minimum. Access aisles shall be placed on either side of the parking spaces except be located on the passenger side for van parking spaces. Van parking spaces shall be permitted to be 9' x 18' minimum where the access aisle is 8' x18' minimum.
3. Access aisles 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..
4. Access aisles (parking spaces as well - similar application) shall not overlap the vehicular way. CBC Section 11B-502.3.4.
5. A vertical clearance of 8'-2" minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. CBC Section 11B-502.5.

F. At least one passenger loading zone shall be provided in every continuous 100 linear feet of loading zone space, or fraction thereof, complying with CBC Section 11B-209 and CBC Section 11B-503as follows:
   1. Vehicle pull-up spaces shall be 8' x 20' minimum. Access aisles shall be 5' x 20' minimum and shall be adjacent and parallel to the vehicular pull-up spaces. They shall be the same level with slopes not steeper than 1:48 in any direction. CBC Section 11B-503.4.
   2. Access aisles for passenger drop-off and loading zones shall be marked with a painted borderlines around their perimeter. The areas 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-503.3.
   3. A vertical clearance of 9'-6" minimum shall be provided for vehicle pull-up spaces, access aisles, and a vehicular route serving them connecting a vehicular entrance and a vehicular exit. CBC Section 11B-503.5.

G. Bus loading zones and bus stops shall comply with CBC Section 11B-209 and CBC Section 11B-810.2 as follows:
   1. Boarding and alighting areas shall be 8' x 5' minimum, with 8' measured perpendicular to the curb or vehicle roadway edge, and with 5' measured parallel to the vehicle roadway. Slopes in 8' direction shall be 1:48 maximum. Slopes in 5' direction shall be the same as that of the roadway, to the maximum extent practicable. CBC Figure 810.2.2.
   2. Bus shelters shall provide a minimum 30" x 48" clear floor or ground space (36" x 48" or 36" x 60" as applicable in an alcove), with slopes not steeper than 1:48 in any direction, entirely within the shelter complying with CBC Section 11B-305 CBC Section 11B-305.
   3. Bus shelters shall be connected by an accessible route complying with CBC Section 11B-402 to a boarding and alighting area complying with CBC Section 11B-810.2 and CBC Figure 11B-810.3.

H. Electric Vehicle Charging Stations(California):
   1. Where electric charging stations are provided, they shall be provided in accordance with CBC Section 11B-228.3, Table 11B-228.3.2.1 and CBC Section 11B-812.
   2. Accessibility requirements for Public Use or Common Use EVCS facilities:
      a. Vehicle spaces and access aisles serving them shall comply with CBC Section 11B-302. Access aisles shall be at the same level as the vehicle space they serve. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted in vehicle spaces and access aisles. CBC Section 11B-812.3.

b. Vehicle spaces, access aisles serving them and vehicular routes serving them shall provide a vertical clearance of 8’-2” minimum. CBC 11B-812.4.
c. Accessible routes between EVCS parking, equipment and the building or facility served shall be provided per CBC Section 11B-812.5.
d. Vehicle spaces for van accessible, standard accessible, ambulatory, and drive-up EVCS shall meet minimum length and width requirements per CBC Section 11B-812.6.
e. Accessible EVCS stalls shall be marked “EV Charging Only” per CBC Section 11B-812.9 and Figure 11B-812.9.
f. Access aisles for van accessible and standard accessible EVCS shall meet minimum length and width requirements and be marked per CBC Section 11B-812.7 the color of the perimeter, hatch lines and “No Parking” letters shall contrast with the surface color (blue color required for use at non-EVCS accessible parking shall not be used). Effective July 1, 2021, where one parking space and one electric vehicle charging space share an access aisle, access aisle marking shall comply with Section 11B-502.3.3 and shall not be required to comply with Section 11B-812.7.2. Additionally, where four or fewer total EVCS are provided within a facility, the access aisle for non-angled van accessible spaces may be located on either the driver or passenger side of the vehicle space. See CBC 11B-812.7.1 exception and 11B-812.7.2 exception.
g. Where four or fewer total EVCS are provided, identification with an International Symbol or Accessibility (ISA) shall not be required. CBC Section 11B-812.8.1
h. Where five to twenty-five total EVCS are provided, one van-accessible EVCS shall be identified with an ISA complying with section CBC Section 11B-703.7.2.1. The required standard accessible EVCS shall not be required to be marked with and ISA.
i. Where twenty-six or more EVCS are provided, all required van-accessible, and all required standard accessible EVCS shall be identified with an ISA. CBC Section 11B-703.7.2
j. The required ISA identification sign shall be reflective with a minimum 70 square inches; shall be visible from the EVCS it serves. The sign shall be permanently posted either immediately adjacent to the vehicle space or within the projected vehicle space at the head end of the vehicle space. Signs identifying van accessible vehicle spaces shall contain the designation “Van Accessible”. Signs shall be minimum 60” above the finish surface except that if the sign projects into a pedestrian circulation area, they shall be minimum 80” above finish surface per CBC Section 11B-812.8.
k. Ambulatory EVCS complying with CBC Section 11B-812.6.3 shall be required where 26 or move EVCS are provided per CBC table 11B-228.3.2.1.

3.04 INSTALLATION

A. General:
1. Position pavement markings as indicated on drawings.
2. Field location adjustments require approval of Architect.

B. Painted Pavement Markings:
1. Apply in accordance with manufacturer's instructions.
2. Apply in accordance with California MUTCD manual for details not shown.
3. Obliterating Paint: Apply as necessary to cover existing markings completely.
4. Marking Paint: Apply uniformly, with sharp edges.
a. Applications: One coat.
b. Wet Film Thickness: 0.015 inch, minimum.
c. Stencils: Lay flat against pavement, align with striping, remove after application.
d. Length Tolerance: Plus or minus 3 inches.
e. Width Tolerance: Plus or minus 1/8 inch.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.
B. Perform field inspection for deviations from true alignment or material irregularities.
C. If inspections indicate work does not meet specified requirements, rework and reinspect at no cost to Owner.
D. Allow the pavement marking to set at least the minimum time recommended by manufacturer.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for additional requirements.
B. Temporary Markings: Remove without damaging surfaces.

3.07 PROTECTION

A. Prevent approaching traffic from crossing newly applied pavement markings.
B. Replace damaged or removed markings at no additional cost to Owner.
C. Preserve survey control points until pavement marking acceptance.

END OF SECTION

SECTION 321726
TACTILE WARNING SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

1.02 RELATED REQUIREMENTS

A. Section 321313 - Concrete Paving: Concrete sidewalks.

B. Section 321723.13 - Painted Pavement Markings: Crosswalk and curb markings.

1.03 REFERENCE STANDARDS

A. 49 CFR 37 - Transportation Services for Individuals with Disabilities (ADA); current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way; 2011.

D. SAE AMS-STD-595 - Colors Used in Government Procurement; 2017a.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Warranty: Submit manufacturer warranty; complete forms in Owner's name and register with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver to project site in manufacturer's protective wrapping and in manufacturer's unopened packaging.

B. Store covered and elevated above grade and in manufacturer's unopened packaging until ready for installation. Maintain at ambient temperature between 40 and 90 degrees F.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Plastic Tiles: Provide manufacturer's standard five year warranty against manufacturing defects, breakage or deformation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Tactile and Detectable Warning Surface Tiles:

2.02 TACTILE AND DETECTABLE WARNING DEVICES

A. Plastic Tactile and Detectable Warning Tiles: ADA Standards compliant, glass fiber and carbon fiber reinforced, exterior grade, matte finish polyester sheet with truncated dome pattern, solid color throughout, internal reinforcing of sheet and of truncated domes, integral radius cut lines on back face of tile; with factory applied removable protective sheeting.
   1. Pattern: In-line pattern of truncated domes complying with ADA Standards.
   2. Color: As selected by Architect from manufacturer's standard range.
   3. Color: SAE AMS-STD-595, Table IV, Federal Yellow No. 33538.
   4. Products:

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Install in accordance with manufacturer's written instructions.
   1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.
   2. Do not install when ambient or substrate temperature has been below 40 degrees F during the preceding 8 daylight hours.

B. Field Adjustment:
   1. Locate relative to curb line in compliance with ATBCB PROWAG, Sections 304 and 305.
   2. Orient so dome pattern is aligned with the direction of ramp.

C. Install units fully seated to substrate, square to straight edges and flat to required slope.

END OF SECTION

SECTION 321740
STREETBOND SB150 (FLAT SURFACE)

PART 1 - GENERAL

1.01 DESCRIPTION

A. StreetBond® Advanced Coatings for Asphalt are specifically formulated for application to asphalt pavement and have been confirmed by a certified testing facility to possess a balance of performance properties for a durable and color-fast finish.

B. A variety of StreetBond® coating colors are available. Please refer to gaf.com to view these. Custom colors are available upon request.

C. Certain colors of the StreetBond® coatings have been independently verified to have an SRI greater than 29 and therefore can help projects qualify for points in the LEED® program under Heat Island Effect: Non-Roof. Please refer to gaf.com for further information.

D. Qualifications. Only Accredited StreetBond® Applicators may bid for and perform the imprinted portion of this work. Please refer to Section 1.03 DEFINITIONS.

E. StreetBond® products are manufactured in ISO 9001:2008 / ISO 14001:2004 facilities to ensure quality products produced in legally-responsible and environmentally-

F. conscious manner

G. StreetBond® coatings are only available from GAF.

1.02 REFERENCES

A. A. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Tester.

B. B. ASTM D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

C. C. ASTM D2697 Standard Test Method for Volume of Nonvolatile Matter in Clear or Pigmented Coatings.

D. D. ASTM D522-93A Standard Test Method for Mandrel Bend Test of Attached Organic Coatings.

E. E. ASTM D1653 Standard Test Method for water vapor transmission through organic film coatings.

F. F. ASTM G154 QUV Accelerated Weathering Environment. Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

G. G. ASTM D2369 Weight Solids Standard test method for Volatile Content of Coatings.

H. H. ASTM D1475 Standard Test Method for Density of Paint, Varnish, Lacquer, Other related products

I. I. ASTM D2240 (2000) Standard Test Method for Rubber property - Durometer hardness.

J. J. ASTM D5895 Standard Test Method of drying or curing during film formation of organic coatings using mechanical recorders.

K. K. ASTM D570 Standard Test Method for water absorption of plastics.

1.03 DEFINITIONS

A. “Accredited StreetBond® Applicator” has valid Certification for both Textured (stamped) and Non - Textured (flatwork) as offered by GAF and are reviewed on an annual basis. All Accredited StreetBond® Applicators have been qualified by GAF to perform the Work and offer a product Warranty.

B. “Approved Applicator” has valid Certification for non - textured (flatwork) application ONLY as offered GAF and are reviewed on an annual basis. Product Warranties may be available to Approved Applicators but require approval and supervision by a GAF Technical Sales Representative.

C. “Applicator” means the installer of the StreetBond® coatings.

D. “Owner” means the Owner and refers to the representative person who has decision making authority for the Work.

E. “TSR” is a GAF Technical Sales Representative who manages the StreetBond® product in a given territory.

F. “Stamped asphalt pavement” is asphalt pavement that has been subjected to imprinting or texturing in a specific pattern.

G. “Non - Stamped asphalt pavement” is asphalt pavement that is unstamped and is sometimes referred to as “flatwork”.

H. The “Work” is the asphalt pavement texturing work contemplated in this bid submission and specification.

I. “Scuffing” is a “tear” of the asphalt pavement caused by an external force - for example turning the steering wheel of a stationary vehicle. Scuffing is generally the result of poorly designed or improperly installed asphalt and would most - commonly be seen on weaker residential asphalt.

J. “Layer” is a signal thin pass of coating, applied with a texture spray gun, which is allowed to dry before the next layer is applied.

K. “Warranty” is a guarantee to the property owner that StreetBond® SB150, when properly applied will not peel, delaminate or show abnormal wear over specific period of time depending on the traffic volumes and number of layers applied. Please contact your local TSR for more details.

1.04 1.4 SUBMITTALS

A. A copy of the Accreditation Certificate, available from the Applicator, is required with submittal. Independent product test results available upon request.

PART 2 - PRODUCTS

2.01 **MATERIALS - STREETBOND® COATINGS**

A. StreetBond® coatings have been scientifically formulated to provide the optimal balance of performance properties for a durable, long - lasting color and textured finish to asphalt pavement surfaces. Some of these key properties include wear and crack resistance, color retention, adhesion, minimal water absorption and increased friction properties. StreetBond® coatings are environmentally safe and meet EPA requirements for Volatile Organic Compounds (VOC).

B. StreetBond® SB150 is a two part premium epoxy - modified, acrylic, waterborne coating specifically designed for application on asphalt pavements. It has a balance of properties to ensure good adhesion and movement on flexible pavement, while providing good durability. StreetBond® SB150 is durable in both dry and wet environments.

C. StreetBond® Colorant is a highly concentrated, high quality, UV stable pigment blend designed to add color to StreetBond® SB150 coatings. One unit of Colorant shall be used with one pail of StreetBond® coating material.
   1. Custom Colors
      a. Match RAL colors noted on plans/details.

2.02 PROPERTIES OF STREETBOND® COATINGS

A. The following tables outline the test results for physical and performance properties of the StreetBond® coatings as determined by an independent testing laboratory.

B. TABLE 1: Typical Physical Properties of StreetBond® Coatings

Characteristic	**Test Specification**	**SB150**
Solids by Volume	ASTM D2697	59.17%
Solids by Weight	ASTM D2369	71.60%
Density	ASTM D1475	13.27 lbs./gal. (1.59 kg/l)

C. TABLE 2: Typical Performance Properties of StreetBond® Coatings
   1. Characteristic
   2. Dry time (To re-coat)
      a. Test Specification - ASTM D5895 23 C; 37% RH
      b. SB150 - 35 min.
   3. Taber Wear Abrasion Dry H-10 wheel
      a. Test Specification - ASTM D4060 1 day cure
      b. SB150 - 0.33g/1000 cycles
   4. Taber Wear Abrasion Wet H-10 wheel
      a. Test Specification - ASTM D4060 7 days cure
      b. SB150 - 0.15g/1000 cycles
   5. QUV Accelerate Weathering Environment
      a. Test Specification - ASTM G - 151 deltaE 1,500hrs.
      b. SB150 - 0.53 (Brick)
   6. Hydrophobicity Water Absorption
      a. Test Specification - ASTM D570
      b. SB150 - 7.89%
   7. Shore A Hardness
      a. Test Specification - ASTM D2240
      b. SB150 - 80.8
   8. Mandrel Bend
      a. Test Specification - ASTM D522 - 93A
      b. SB150 - 1/8” @ 23 C
   9. Permeanc
      a. Test Specification - ASTM D1653
      b. SB150 - 5.6 perm
   10. VOC
      a. Test Specification - per MSDS
      b. 19 g/l
   11. Adhesion
      a. Test Specification - ASTMD4541
      b. SB150 - >300psi (692psi)
   12. Friction Wet
      a. Test Specification - ASTM E303 British Pendulum Tester
      b. SB150 - Wet=77.3 Dry=81.3

D. Certificates of Analysis are available upon request for each of these properties.

2.03 **EQUIPMENT FOR STREETBOND® APPLICATION**

A. The equipment described has been designed specifically for optimal application of StreetBond® coatings. Other equipment may or may not be suitable and could compromise the performance of the StreetBond® coatings and/or reduce crew productivity.
   1. The SB Flex Sprayer is a proprietary coating sprayer supplied by Intech Equipment and is capable of applying the StreetBond® coatings to the asphalt pavement surface in a thin, controlled film which will optimize the drying and curing time of the coating. A Graco RTX and RapidSprayerII sprayer may also be used.
   2. The StreetBond® Coatings Mixer is a motorized mixing device designed to ensure efficient and thorough blending of the StreetBond® components.
   3. Backpack or Hand - Held sprayer to apply the diluted StreetBond® Adhesion Promoter Concentrate.
   4. The RapidFinisher II is an electric powered broom produced by HUB Surfaces Systems which can be used in the application of StreetBond® coatings to improve productivity. It is especially useful on larger projects.

PART 3 - EXECUTION

3.01 **GENERAL**

A. StreetBond® coating shall be supplied and applied on non - textured paving surface by an Accredited StreetBond® Applicator in accordance with the plans and specifications or as directed by the Owner. Do not begin installation without confirmation of an Accreditation Certificate. Specifications for the execution of the StreetPrint® system can be found at gaf.com .

3.02 **PRE-CONDITIONS**

A. The condition of the paving substrate will impact the performance of the StreetBond® coatings. A highly stable asphalt pavement free of defects is recommended.

B. Prerequisites for New Pavement
   1. A durable and stable asphalt pavement mix design installed according to best practices over a properly prepared and stable substrate is a pre - requisite for all long - lasting asphalt pavement surfaces. The application of StreetBond® does not change this requirement.

C. Pavement Marking Removal: recommended guidelines
   1. Pavement markings may be removed by sandblasting, water - blasting, grinding, or other approved mechanical methods. The removal methods should, to the fullest extent possible, cause no significant damage to the pavement surface.
   2. The Owner shall determine if the removal of the markings is satisfactory for the application of StreetBond® coatings. Work shall not proceed until this approval is granted.

D. Surface Preparation
   1. The asphalt pavement surface shall be dry and free from all foreign matter, including but not limited to dirt, dust, de-icing materials, and chemical residue.

3.03 **APPLICATION OF STREETBOND® COATINGS**

A. Coating Application Guidelines

1. The Applicator shall use the SB Flex Spray System or suitable texture coatings sprayers to apply the StreetBond® coatings.
2. The pavement surface shall be completely dry and thoroughly cleaned prior to application of the coatings.
3. The coating application shall proceed as soon as practical upon completion of the imprinting of the asphalt pavement where applicable.
4. For polished asphalt, StreetBond® Adhesion Promoter should be applied directly to the asphalt and allowed to dry completely prior to the first layers of coating.
5. For concrete surfaces, StreetBond® WB Concrete Primer or StreetBond® QS Concrete Primer should be applied and allowed to cure prior to the first layers of coating. Please consult Technical Data sheets for more details on applications.
   a. Both new and existing concrete should be acid etched prior to the primer application.

B. The first layer of coating shall be spray applied then broomed to work the coating material into the pavement surface. Subsequent applications shall be sprayed then broomed or rolled. Each application of coating material shall be allowed to dry to the touch before applying the next layer.
   1. Airless sprayers cannot be used due to high aggregate content of StreetBond.

C. The Applicator shall apply the StreetBond® coatings only when the air temperature is 50°F / (10°C) and rising and will not drop below 50°F / (10°C) within 24 hours. No precipitation should be expected within 24 hours.

D. Follow manufacturers Application and Specifications Manual for process and procedures on the application of StreetBond. (www.gaf.com)

E. Use equipment that is designed specifically for the application of StreetBond.
   1. Refer to GAF information in the StreetBond Application and Specifications Manual. (www.gaf.com)

3.04 **COATING COVERAGE & THICKNESS**

A. Coating coverage and thickness is as outlined in TABLE 4 below. Actual coverage may be affected by the texture of the asphalt pavement substrate and the imprint pattern selected. There will be less coverage with the first layer and higher coverage with subsequent layers.

B. TABLE 4: Coating Coverage & Thickness

Use	Min # of Layers	App. Rate/Layer	Total App./rate for system	Dry Film Thickness (DFT) mils
No vehicular traffic(pedestrian)	3	1 unit/600 sf	3 units/600 sf	18
Low vehicular traffic(<5 cars/day residential drives/medians/plazas	3	1 unit/600 sf	3 units/600 sf	19
Medium vehicular traffic (<2000 cars/day)	4	1 unit/600 sf	4 units/600 sf	26
Heavy vehicular traffic (2000-3000 cars/day)	4	1 unit/600 sf	4 units/600 sf	26
Vehicular Traffic - Turn Lanes (<3000 cars/day)	6	1unit/600 sf	6units/600 sf	38

C. Additional layers of StreetBond® SB150 coatings may be used to provide additional build thickness in high wear areas such as vehicle wheel paths and turning areas.

D. *1 unit is a nominal 5 gallon pail comprising Part A, Part B and Colorant (approximately 4.12 gallons). 1 unit when sprayed as a single layer covers approximately 600sqft (55.7 sqm), with an approximate thickness of 6.3mil (0.16mm) dry.

E. No warranty is provided for traffic levels above 3000 cars per day per lane.

3.05 **OPENING TO TRAFFIC**

A. Minimally, StreetBond® SB150 coating must be 100% dry and sufficient curing time must be allowed before traffic is permitted on the surface.

B. If StreetBond® coatings are applied when moisture cannot evaporate, then the coating will not dry. The drying and curing of StreetBond® coatings have a direct impact on performance.

3.06 **MEASUREMENT**

A. The measured area is the actual area of asphalt pavement where StreetBond® has been applied, measured in place. No deduction will be made for the area(s) occupied by manholes, inlets, drainage structures, bollards or by any public utility appurtenances within the area.

END OF SECTION

SECTION 323119
TUBE STEEL FENCES AND GATES

PART1 GENERAL

1.01 SECTION INCLUDES

A. Tube steel fencing.
B. Tube steel gates.
C. Accessible gate hardware
D. Horizontal sliding gates.

1.02 RELATED REQUIREMENTS

A. Division 03 Section Cast-in-Place Concrete
B. Division 07 Section Joint Sealants
C. Division 09 Section High Performance Exterior Metal Coatings
D. Division 32 Section Concrete Paving
E. Division 32 Section Architectural Site Concrete

1.03 SUBMITTALS

A. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
    1. Prepare Project specific information, drawn accurately to scale. Shop Drawings shall not be reproductions of the Contract Documents or any standard printed data.
    2. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for the preparation.
B. Product data in the form of manufacturer's technical data, specifications, and installation instructions for fence and gate posts, fabric, gates, hardware and accessories specified in the section.
    1. Fence and gate posts, rails, and fittings.
    2. Gates and hardware, including accessible gate lever lockset.
    3. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has at least three years' experience and has completed at least five tube steel fence projects with same material and of similar scope to that indicated for this Project with a successful construction record of in-service performance.
B. Single-Source Responsibility: Obtain tube steel fences and gates, including accessories, fittings, and fastenings, from a single source.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for fences and gates shown on the Drawings in relation to the property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.01 TUBE STEEL FENCE

A. All parts shall be tube steel. All posts, frames, rails, and braces parts shall be tube steel meeting the requirements of ASTM A 500 grade B.787. All other tube steel shall meet the requirements of ASTM A 513. All posts shall have a welded post cap.
   1. Sizes shall be as noted below:

Item	O.D.	Wall Thickness
Line Post	3"	12 GA.
Corner Post	4"	11 GA.
Fence Top Rail	1-3/4"	14 GA.
Fence Bottom Rail	1-3/4"	14 GA.
Pedestrian Gate Post	4"	11 GA.
Vehicular Gate Post	6"	0.250"
Pedestrian Gate Rails, Frame and Braces	2"	0.188"
Vehicular Gate Rails, Frame and Braces	2"	0.188"
Vehicular Gate Bottom Rail	2"	0.188"
Pedestrian Fence and Gate Pickets	1"	14 GA.
Vehicular Gate Pickets	1"	14 GA.

B. Infill Panels: Custom design as indicated on Drawings.

C. Steel Finish: Powder Coating.

2.02 VEHICLE GATES

A. Gates shall be located as shown on the Drawings and sized to suit existing walkways and roadways. All vehicular gates shall have a minimum clear opening of 20 feet designated for Fire Department access. Materials used shall be equal to or greater than that used in adjoining sections of fence and be compatible with the application.

B. Steel Finish: Powder Coating.

2.03 PEDESTRIAN GATES

A. Pedestrian gates shall have a ladder type frame, i.e., two vertical ends and two horizontal rails and made of steel tubing, gate pickets, provisions for locking hardware, kickplate/kickbox, drop rod and gate hardware.

B. Frame Corner Construction: Welded with an intermediate rail for panels 5 feet (1.52 m) wide or wider.

C. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Provide center gate stops and cane bolts for pairs of gates.

D. Steel Finish: Powder Coating.

2.04 HARDWARE

A. Pedestrian Gate Hardware: Provide galvanized hardware and accessories for each gate according to the following:

B. Accessible Latch/Lockset: Locksets shall be heavy-duty with hinged, anti-friction, 1-inch throw latchbolt with anti-friction piece made of self-lubricating stainless steel. Provide locksets with interchangeable core cylinders. Provide double cylinder, keyed to match building exterior doors. Locksets to be furnished with thru-bolted hardware to attached through gate frame, round or square post stock. Lever handles must be of forged or cast brass, bronze or stainless steel construction.
   1. Basis-of-Design Product: Schlage L9070T SPA 626 IC Core 20-740-626. For use with panic hardware use Schlage rim cylinder 20-057 ICX 626, IC Core 20-740-626.
   2. Locksets to be furnished with thru-bolted hardware to attached through gate frame, round or square post stock. Lever handles must be of forged or cast brass, bronze or stainless steel construction

C. Kickplate: Smooth solid metal surface (12GA), to match frame material and finish, along the entire width of the gate, and minimum of 10” above the pedestrian surface to be provide at all accessible pedestrian gates.

D. All gate drop rod assemblies are to use a 1/2" diameter solid steel center stop. Provide a 12" steel sleeve. In asphalt areas secure sleeve in a 12" diameter by 18" deep concrete footing.

E. All non-automated vehicular and fire lane gates shall have a hold open post. Posts shall have a provision for locking the gate to the post in the open position.

F. Pedestrian Gate Hinges:
   1. Locinox Mammoth-HD
      a. Color: Black(9005)

G. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
   1. Basis of Design: Duprin 98L, 630 finish with rim cylinder.
   2. Function: 04 - Entrance by trim when latch bolt is released by key or set in a retracted position by key.
   3. Mounting Channel: Bent-plate channel formed from 1/8-inch- (3.2-mm-) thick, steel plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch (3.2 mm) beyond push pad surface.

H. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch- (12.7 -mm-) diameter, round steel bars, hot-dip galvanized after fabrication, unless otherwise shown on drawings. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

I. Gate Keeper: Galvanized steel, duckbill type to auto-engage in open position and hold open. High Performance coating to match fence and gate color.

J. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with **CBC Section 11B-404.**

K. The lever of lever actuated 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. **California Referenced Standards code. T-24 part 12, Section 12-10-202, Item (F).**

L. 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 th 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 plates shall be capped. **CBC Section 11B-404.2.10**

M. The clear opening width for a door shall be 32" minimum. For a swinging doors it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34" and 4" maximum projections into it between 34" and 80" above the finish floor or ground. Door closers and stops shall be permitted to be 78" minimum above the finish floor or ground. **CBC Section 11B-404.2.3**

N. Handles pulls, latches, locks, and other operable parts on accesisible doors shall comply with **CBC Section 11B-309.4** and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34" minimum and 44" maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usalbe from both sides. **CBC Section 11B-404.2.7**

O. The force for pushing or pulling open a door shall be as follows: **CBC Section 11B-404.2.9**
   1. Interior hinged doors, sliding or folding doors: **5 pounds(22.2N)** maxiumum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed **15 pounds (67N)**. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
   2. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds(22.2 N)maximum to comply with CBC Section 11B-309.4

P. Door closing speed shall be as follows: **CBC Section 11B-404.2.8**
   1. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is **5** seconds min.
   2. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is **1.5** seconds minimum.

Q. Thresholds shall comply with **CBC Section 11B-404.2.5**

R. Floor stops shall not be located in the path of travel and 4" maximum from walls. **DSA Policy 99-08**.

S. Hardware (including panic hardware) shall not be provided with "Night Latch" (NL) function for any accessible doors or gates unless the following conditions are met per **DSA Interpretation 10-08 DSA/AC (External), revised 4/28/09.** Such conditions must be clearly demonstrated and indicated in the specifications:
   1. Such hardware has a 'dogging' feature.
   2. It is dogged during the time the facility is open.
   3. Such 'dogging' operation is performed only by employees as their job function(non-public use).

T. Pair of doors: limit swing of one leaf to 90 degrees so that a clear floor space is provided beyond the arc of the swing for the wall-mounted tactile sign. **CBC Section 11B-703.4.2.1**

2.05 HORIZONTAL SLIDE GATES

A. Gate Configuration: Single leaf.
   1. Type: Cantilever slide, with external roller assemblies.

B. Gate Frame Height: 72 inches (1830 mm).

C. Gate Opening Width: As indicated on drawings.
   1. Steel Frames and Bracing: Fabricate members from square tubing. [Hot-dip galvanized frames after fabrication.]

a. Frame Members: Steel tubing 2 by 4 inches (50 by 100 mm)] with 1/8-inch (3.2-mm) wall thickness.
b. Bracing Members: Steel tubing 2 by 2 inches (50 by 50 mm) with 1/8-inch (3.2-mm) wall thickness.

D. Frame Corner Construction:
1. Welded frame with panels assembled with bolted corner fittings.

E. Additional Rails: Provide as indicated, complying with requirements for fence rails.

F. Infill: Comply with requirements for adjacent fence.

G. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence.

H. Hardware: Latches permitting operation from both sides of gate, hangers, roller assemblies, and stops fabricated from galvanized steel.

I. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

J. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

K. Steel Finish: High-performance coating.

2.06 FINISHES

A. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

B. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
1. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

C. Powder Coating: Immediately after cleaning, apply 2-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 8 mils (0.20 mm). Comply with coating manufacturer's written instructions.
1. Color as noted on plans.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.
1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 200 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, property monuments, property lines, and easements.

3.03 PERFORMANCE REQUIREMENTS

A. All gates shall be designed and constructed to withstand the weight of a 200 pound person standing at the mid-point on the lower rail without permanent deformation of any component members of the assembly.

B. Fabricator to provide structural calculations for each type gate verifying the performance requirements of this section.

3.04 ON THE JOB SITE

A. After the fence has been erected and is mechanically complete, wire brush field welds, dry wipe off all loose residue, spot prime with the Zinc Chromate all bare metal, bare spots and chips, and unpainted surfaces. Then spray a finish coat over the entire fence installation with one coat of industrial quality coating. Care shall be taken to keep paint off of sidewalks, wall, etc.

3.05 FABRICATION AND INSTALLATION

A. Fencing shall be welded and have smoothed, clean, slag free welds. Dimensions and installation shall be in accordance with the drawings.

B. The lever of lever actuated 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. **California Referenced Standards code. T-24 part 12, Section 12-10-202, Item (F).**

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 th 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 plates shall be capped. **CBC Section 11B-404.2.10**

3.06 POST SETTING

A. General: Comply with ACI 301 for cast-in-place concrete.

B. Materials: Portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94.
   1. Concrete Mixes: Normal-weight concrete with not less than 3000-psi (20.7- MPa) compressive strength (28 days), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum size aggregate.

C. All posts to be set in concrete as detailed on the drawings.

D. All posts to have concrete domed to shed water. All posts to be set to a maximum of 8 feet O.C. All post to be set plumb, in line, and to correct height. A Corner Post is required when line of fence direction changes 30 degrees or more.

E. All posts set in existing concrete slabs to be set in a 6 inch core drilled hole and set to a depth of 24 inches. All 6 inch gate posts set in existing concrete slabs are to be set in 12 inch square saw cut to a depth of 43 inches.

3.07 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by the manufacturer in writing for exterior applications.

3.08 GATE INSTALLATION

A. General: Install gates level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.09 SITE CLEAN UP

A. The construction site shall be cleaned up and all accumulated debris removed by the Contractor.

END OF SECTION

SECTION 323136
SECURITY GATES AND BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Controls and related wiring.

1.02 RELATED REQUIREMENTS

A. Section 260533.13 - Conduit for Electrical Systems: Empty conduit between system components.

B. Section 260583 - Wiring Connections: Electrical power connections to the hydraulic power unit and controls.

C. Section 312316 - Excavation: Excavating for footings, and utility trenching.

D. Section 321216 - Asphalt Paving: Installation of adjacent paved surfaces.

E. Section 321313 - Concrete Paving: Installation of adjacent paved surfaces.

1.03 REFERENCE STANDARDS

A. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction; 2020.

B. ASTM F2656/F2656M - Standard Test Method for Crash Testing of Vehicle Security Barriers; 2023.

C. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of units with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of work of this section; require attendance by affected installers.

C. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Provide detailed drawings showing:

1. Layout and overall dimensions of each major element of the barrier equipment, including the hydraulic power unit and operator control panels, if applicable.
2. Foundation and anchoring requirements of the barrier equipment.
3. Electrical schematic including associated wiring, showing electrically connected components, including interface points for connection to equipment; indicate minimum conduit size and number of wires required to run between each component of the barrier equipment.
4. Schematic drawings of the entire barrier system, with manufacturer supplied equipment connected and integrated.

C. Certificate: Certify that products of this section meet or exceed specified requirements.
   1. Submit crash test certification on the barrier.
   2. Submit Certificate of Conformance that the barrier delivered conforms to the crash rating, performance and requirements of this specification.

D. Test Reports: Indicate test data and results of field tests, including the demonstration and compliance with the specified performance criteria and final position of component adjustments and set points.

E. Installer's Qualification Statement.

F. Operation and Maintenance Data.

G. Specimen Warranty.

H. Project Record Documents: After completion of field tests, provide updated drawings, showing exactly where equipment and controls are installed.

I. Maintenance Materials: Furnish the following for Owner's use in project maintenance.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

B. Installer's Qualifications: Company specializing in performing the work of this section with minimum ten years of documented experience.

1.07 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

C. Provide one year manufacturer warranty for materials and workmanship.

PART 2 PRODUCTS

2.01 AUTOMATED GATES AND BARRIERS

A. Automated Gates and Barriers - General: Having following characteristics as well as characteristics specified for each type:
   1. Comply with UL 325, Class I and ASTM F2200.
   2. Operation: Opening and closing..
   3. Material: as noted on plans/details..
   4. Color: as noted on plans/details..
   5. Position Sensor: open.
   6. Control Type: Radio transmit.
   7. Detection Systems: Wrong-way and intrusion.
      a. Optex Sensor
      b. In Ground safety loops
      c. Photo-eye
      d. Edge sensor

8. Programming: Human Machine Interface Programmable Logic Controller (HMI PLC).
9. Weight Limitations on Gate leaf: 15,000 pounds.
10. Speed Limitations on Retractable Barriers: 15 mph.
11. Empty conduit between system components is specified in Section 260533.13.
12. Electrical power connections and wiring for hydraulic power unit and controls is specified in Section 260583.
13. Main Operator Control Panel.
14. Remote Operator Control Panel.
15. Emergency Fast Operate (EFO).
16. Battery Back-up.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Verify location of existing utilities, grades and conditions of substrate.
   2. Verify existing vehicle detector loops, including their size, geometry and wiring.
   3. Verify integration requirements with other site security equipment including but not limited to card readers, tire puncture devices, gates and other automated barrier systems.

3.02 PREPARATION

A. Protect existing work from damage due to installation of this work.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

3.05 SYSTEM STARTUP

A. Provide manufacturer's field representative to observe systems startup.

B. Prepare and start equipment in accordance with manufacturers' instructions and recommendations.

C. Adjust for proper operation within manufacturer's published tolerances.

3.06 CLEANING

A. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

B. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of the barrier to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

E. Training: Train Owner's personnel on operation and maintenance of the barrier.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.

3.08 PROTECTION

A. Protect installed units from subsequent construction operations.

B. Do not permit traffic over unprotected barrier device.

3.09 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 323300
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drinking Fountain
B. Wood Boat, Planks, and Logs.
C. Boulders

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Bollard infill and underground encasement.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
E. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
F. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
G. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.
H. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2012.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.
C. Shop Drawings: Indicate plans for each unit or groups of units, elevations with model number, overall dimensions; construction, and anchorage details.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
B. Provide manufacturer’s warranty against defects in materials or workmanship for ductile iron castings for a period of 10 years from Date of Substantial Completion.
C. Provide manufacturer’s Lifetime Warranty against defects in materials or workmanship for wood benches manufactured from solid teak.

PART 2 PRODUCTS

2.01 METAL FURNISHINGS

A. Drinking Fountain w/bottle filler: Stainless Steel
   1. Shape: Round.
   2. Mounting: Use direct bury option: 97890C.
   3. Products:
      a. ELKAY LK4430BF1U.
   4. Finish: Refer to L0.01 Site Furnishings Legend for color/finish.

2.02 WOOD BOAT, PLANKS AND LOGS

A. Materials:
   1. Wood:
      a. Stool - Forest Ponderosa/Jeffrey Pine.
      b. Planks(Decking) - Sugar Gum Eucalyptus.
      c. Logs - Sugar Gum Eucalyptus.
   2. Finish: As noted on L0.01 Site Furnishing Legend.

B. Stool: Solid wood.
   1. Shape: ____.
   2. Height: ~18.5 inches.
   3. Diameter: ~15 - 28 inches.

C. Decking:
   1. Length: 96 inches
   2. Width: 5-1/2 inches
   3. Thickness: 1 inches

D. Products:
   1. Angel City Lumber.

2.03 BOULDERS

A. Various sizes, refer to Boulder Legend on sheet L0.01.

B. Supplier: Southwest Boulder and Stone.

C. Type: Navajo

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mounting surfaces, preinstalled anchor bolts, or other mounting devices are properly installed; and ready to receive site furnishing items.

B. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.

B. Provide level mounting surfaces for site furnishing items.

END OF SECTION

SECTION 323353
ARCHITECTURAL SITE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Concrete freestanding site walls.
B. Concrete retaining walls.(48" or less in height)
C. Concrete cheek walls for exterior concrete stairs.
D. Skateboard deterrents.
E. Light pole bases.
F. Other architectural site concrete as indicated.

1.02 RELATED REQUIREMENTS

A. Division 00 Section - 003100 Available Project Information(Geotechnical Report)
B. Division 07 Section - Joint Sealants
C. Division 09 Section - Permanent Non-Sacrificial Anti-Graffiti
D. Division 32 Section - Concrete Paving
E. Division 32 Section - Concrete Paving Joint Sealants

1.03 DEFINITIONS

A. Cast-in-Place Architectural Site Concrete: Non-building formed concrete that is exposed to view in completed exterior work and that requires concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
B. Cementitious Materials: Portland cement alone or in combination with one or more of the following: Fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
C. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural site concrete.
D. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

1.04 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at project site.
    1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place architectural site concrete to attend, including the following:
        a. Contractor's superintendent.
        b. Independent testing agency responsible for concrete design mixtures.
        c. District's Representative(s).
        d. Architect's Representative(s)
        e. Cast-in-place architectural site concrete subcontractor.

f. Inspector of Record (IOR).
g. Subcontractor for any adjacent work

2. Review testing and inspection procedures, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of cast-in-place architectural site concrete.
3. Contractor to provide meeting minutes for pre-installation conference.

1.05 SUBMITTALS

A. Product Data: For each type of product.
   1. Proprietary admixtures, pigments, curing compounds, hardeners, sealers, form-release agents, all accessory material, etc.: Indicate compatibility with other materials used.

B. Samples for Initial Selection: For each type of product, ingredient or admixture requiring color selection.
   1. Submit manufacturer selected range of colors and products for review.
   2. Provide custom colors or samples as required.
   3. Upon selection of color submit 12"X12" sample of material in the specified color/finish for review by the Landscape Architect in addition to the specified mock-ups.

C. Design Mixtures: Submit proposed mix designs and test data for each class, color, application, and strength of concrete and for each method of placement.
   1. Prepare mix designs on the basis of field experience (preferred) and/or trial mixes, in compliance with California Building Code (CBC), Section 1905A.3.
   2. Mix designs shall be prepared and signed by a structural or civil engineer registered in the State of California.
      a. Mix designs shall be reviewed by the Architect and Structural Engineer of Record (SEOR).
   3. Identify for each mix design submitted the method by which proportions have been selected.
      a. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength calculations.
      b. For mix designs based on trial mixtures, include trial mix proportions, test results, graphical analysis and show required average compressive strength face results. Provide gross weight and yield per cubic yard of trial mixes.
      c. Indicate quantity of each ingredient per cubic yard of concrete.
      d. Indicate type and quantity of admixtures proposed or required.
      e. Indicate water to cement ratio by weight.
      f. Measured slump.
      g. Measured air content.
      h. Provide shrinkage test results.
      i. Provide maximum [5%] fly ash; ground granulated blast-furnace slag, and/or silica fume content as Portland cement replacement in all concrete.
      j. No fly ash will be permitted
   4. Submit proposed alternate design mixtures for review by the Architect and SEOR(Strutural Engineer of Record) when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   5. Mix designs for each application must be from a single source for the duration of the project. Multiple venders or courses will not be permitted.
   6. All mix designs must be wet stamped by a licensed Engineer.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
   1. Coordinate with and identify the details of the Contract Drawings on the shop drawings.
   2. Comply with ACI 315, part B and CRSI requirements.

E. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural site concrete.
   1. Engineering Responsibility: Formwork shop drawings shall be prepared by or under the supervision of a licensed professional engineer detailing fabrication, assembly, and support of formwork.
   2. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
   3. Location of form ties and patterns are subject to approval of the Landscape Architect. For walls less than 18” high, ties to be located above and below wall face, whenever possible.
   4. Align all form joints with reveal locations indicated on plans. Provide custom size and cut form boards as required.

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure. Submit dimensioned drawing indicating layout of construction joints, contraction (control) joints, dowelled joints, decorative scoring and placement sequence of concrete.
   1. Location of construction joints are subject to approval of the Architect.
   2. Construction joints locations should align with reveal locations as located per drawings.
   3. Provide custom form boards as required for joint alignment noted per drawings.
   4. Align all form joints with reveal locations indicated on plans. Provide custom size and cut form boards as required.

G. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.

H. Samples: For each of the following materials:
   1. Form-facing panel.
   2. Form ties.
   3. Form liners.
   4. Coarse- and fine-aggregate gradations.
   5. Chamfers and rustications.
   6. Reveals
   7. One quart sample of sand and fine aggregate
   8. On quart sample of coarse aggregate

I. Qualification Data: For manufacturer (batch plant).

J. Welding Certificates: Submit certifications signed by AWS Certified Welding Inspector of prequalified welding procedures, qualifications of welding procedures unless prequalified, qualifications of welding operators and qualifications of welders.

K. Material Certificates: For each of the following:
   1. Cementations materials.
   2. Aggregates and sand.
   3. Admixtures.
   4. Form materials and form-release agents.
   5. Steel reinforcement and accessories.

a. Provide mill test certificates for all reinforcing steel, showing physical and chemical analyses. For steel that will be welded, include in the chemical analysis the percentages of carbon, manganese, copper, nickel, chromium, phosphorus and sulfur, and optionally, the percentages of molybdenum and vanadium.

6. Curing compounds.
7. Surface treatments.
8. Bonding agents.
9. Adhesives.
10. Semi rigid joint filler.
11. Joint-filler strips.
12. Repair materials.

L. Material Test Reports: For the following, by a qualified testing agency:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

M. Field Quality-control Reports. Submit reports of all compressive strength, slump, shrinkage and air content tests required by the authorities having jurisdiction and as indicated.
1. Submit copies of delivery tickets complying with ASTM C 94 for each load of concrete delivered to the site. Tickets shall include all information required by the referenced standard.

N. Minutes of pre-installation conference.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with CBC Chapter 19A.
1. Chemical products field-applied to concrete shall comply with the air quality requirements of authorities having jurisdiction.

B. Industry Standards: Comply with the following unless modified by requirements in the Contract Documents.
1. ACI 301, "Specifications for Structural Concrete".
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".
3. ACI 302.1R, "Guide for Concrete Floor and Slab Construction".
4. ACI 303.1 "Specifications for Cast-in-Place Architectural Concrete".
5. ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete".
6. ACI 305R, "Hot Weather Concreting".
7. ACI 306.1, "Standard Specification for Cold Weather Concreting".
8. ACI 318, "Building Code Requirements for Structural Concrete".
9. ACI 347, "Guide to Formwork for Concrete".
10. ACI 318, "Building Code Requirements for Structural Concrete."
11. ACI SP-66, "ACI Detailing Manual".
12. CRSI, "Manual of Standard Practice".
13. CRSI, "Placing Reinforcing Bars".

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "NRMCA Quality Control Manual - Section 3, Certification of Ready Mixed Concrete Production Facilities."
2. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
3. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

4. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations for Cast-in-Place Architectural Site Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide cast-in-place architectural site concrete of consistent quality in appearance and physical properties for the duration of the project.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specification for Structural Concrete,"Sections 1 through 5 and Section 6, "Architectural Concrete."
   2. ACI 303.1, "Specification for Cast-in-Place Architectural Concrete."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Source Limitations for Concrete Paving: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties. Secure all material required for the duration of the project as needed to ensure consistent quality in appearance

H. Welding Qualifications: Comply with CBC Chapter 17A.
   1. Qualify welding procedures and welding personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel" prior to performing any welding.
   2. Qualify welding inspection personnel according to AWS QC1, "Standard for AWS Certification of Welding Inspectors."

I. Mockups: Before casting architectural site concrete, build mockups to verify selections made under Sample submittals and to fully demonstrate typical joints, surface finish, texture, tolerances, reveals edges, bulkhead or cold joints, standard of workmanship and completed product. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Build mockups full-size, matching architectural site concrete components indicated on the Drawings. Mock-ups shall be complete in every detail, including joints, reveals, chamfers, etc. Include complex joinery conditions where necessary to integrate to other Project components as indicated.
   3. Maintain accurate records of variables associated with each mockup to facilitate the matching of accepted mockups during actual construction.
   4. Demonstrate curing, cleaning, and protecting of cast-in-place architectural site concrete, finishes, and contraction and expansion joints, as applicable.
   5. Required Mock-up Types:
      a. Walls: Construct at least 6 linear feet by 4 foot height of finished concrete site walls for each color, finish, and mix design. Thickness of walls as noted on plans.
      b. Benches and Seats: Construct at least 6 linear feet of finished concrete site benches and seats.
      c. As-Cast Retarder Finishes: Mockups shall clearly demonstrate a consistent depth-of-cut for retarder finishes for Architect's review.
   6. Mock-up Acceptance: Obtain Architect's approval of mockups before casting architectural site concrete.
      a. The mock-up acceptence shall be judged between a distance of 5 feet to 10 feet, at the Architects discretion.

b. The Architect may reject mockups that, in the Architect's sole judgment, do not demonstrate an acceptable completed product, including, but not limited to, color, joint work, surface finish, texture, tolerances, and standard of workmanship
c. The Architect may require modifications to mockups to obtain acceptable results.
d. The Architect may require modifications to mockup repairs to obtain acceptable results.
e. The Architect may require removal and reconstruction of mockups to obtain acceptable results. Multiple mock ups may be required.
f. Contractor shall provide additional mockups as required to obtain results acceptable to the Architect at no additional cost to the Owner.

7. Mockup Disposition: Accepted mockups shall not become part of the completed Project. Maintain mock-up on-site for the duration of construction and until all work has been accepted. Remove and legally dispose mockups after acceptance of final installed work. If sufficient permanent architectural site work has been completed, Contractor may submit a written request to Architect to transfer quality control for architectural site concrete from the accepted mockups to one or more designated portions of the permanent work.

1.07 PROJECT CONDITIONS:

A. Traffic Control: Maintain access for Owner's operations and for vehicular and pedestrian control required for construction activities.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
1. Label bundles with durable identification tags. Maintain reinforcement identification after bundles are broken.
2. Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening contaminants.
3. Avoid damaging applied coatings, if any, on steel reinforcement.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. General: Comply with Division 03 Section "Cast-in-Place Concrete" for formwork and other form-facing material requirements.

B. Form-Facing Panels for As-Cast or Exposed-Aggregate Finishes: Steel, glass-fiber-reinforced plastic, or other approved no absorptive panel materials that will provide continuous, true, and smooth architectural site concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

C. Form-Facing Panels for all exposed As-Cast and Exposed-Aggregate Concrete Finishes: Provide steel, glass-fiber-reinforced plastic, or overlain exterior-grade plywood panels, no absorptive, that will provide continuous, true, and smooth architectural site concrete surfaces, with no wood grain, honeycombing or patch transfer.
1. Faced plywood panels shall comply with, or be equivalent to, DOC PS 1, Structural I. Provide minimum 7-ply plywood and provide balance sheets for panels coated one-side only. Furnish in largest practicable sizes to minimize number of joints.
a. Retarder As-Cast Finish: Medium-Density Overlay (MDO), with mill-applied release agent and edge sealant. Provide one of the following panels, or comparable substituted product:

1) Olympic Panel Products, "B-Matte 333 MDO Concrete Form." Overlay Color: Brown.
2) Pacific Laminate Products, "ProFace MDO." Overlay Color: Black.
3) Sylvan Products, LLC, "Armor Ply MDO" Overlay Color: Brown.

2. Curved Work: Kerf back of plywood form-facing panels, or use accepted flexible or curved forms for curved work with a radius of 100 feet or less to match finish provided by form material noted in items 1 and 2 above.

D. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will provide surfaces without gradual or abrupt irregularities that exceed specified formwork surface class.
1. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
2. Finished work is to be free of seams or form markings.

E. Rustication Strips or Reveals: Wood, metal or rigid plastic, with sides beveled and back kerfed; nonstaining; in longest practicable lengths. Align reveals as shown on plans and with form seams.

F. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch (6 mm) thick.

G. Form Joint Sealant: Urethane or silicone elastomeric sealant complying with ASTM C 920, Type M or Type S, Grade NS that adheres to form joint substrates. Form joint sealant shall be compatible with form-facing panels.

H. Form Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood. Form sealer shall be compatible with form-facing panels. All seams and joints are to be sealed.

I. Form-Release Agent: Commercially formulated, colorless form-release agent that will not bond with, stain, or adversely affect architectural site concrete surfaces and will not impair subsequent treatments of those surfaces. Form-release agent shall be compatible with form-facing panels.
1. Obtain written acceptance of form release agent from integral colored concrete pigment manufacturer.
2. Form-release agents shall be non-staining.
3. Formulate form-release agent with rust inhibitor for steel form-facing materials.

J. Surface Retarder (In Form): Chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.
1. Provide Architectural Concrete Chemicals(ACC) "Altus VOC Series" or accepted comparable substitute.

K. Surface Retarder (Top Surface): Chemical liquid set retarder, for application on top surface of formed applications to match finish at formed faces, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.
1. Provide W. R. Grace "Top-Cast" or accepted comparable substitute.

L. Form Ties: Factory-fabricated, stainless steel or fiberglass color keyed to wall color snap ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish ties with tapered plastic tie cone spreaders that, when removed, will leave holes 3/4 inch in diameter on concrete surface.
2. Furnish internally disconnecting ties that will leave no metal closer than 1-1/2 inches (38 mm) after exposing aggregate, from the architectural site concrete surface.
3. Furnish glass-fiber-reinforced plastic ties, not less than 1/2 inch (13 mm) in diameter, of color selected by Architect from manufacturer's full range.

4. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

M. Provide new forms specifically purchased for this project. Reuse of forms from past projects or contractors stock will not be accepted.

N. Provide custom form boards as required to align seams with reveals indicted on plans.

2.02 STEEL REINFORCEMENT AND ACCESSORIES

A. General: Comply with Division 03 Section "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed, unless otherwise indicated.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."
   1. Where legs of wire bar supports contact forms, use CRSI Class 2, stainless-steel bar supports.

D. Tie Wire: Minimum 16 ga. annealed wire, black, galvanized or coated finish to match rebar.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type II, or Type IV, gray, unless white cement is required to achieve colors indicated. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F.
   2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or Grade 120.
   3. Silica Fume: ASTM C 1240, amorphous silica.
      a. Blended Hydraulic Cement: ASTM C 595, [Type IS, portland blast-furnace slag] [Type IP, portland-pozzolan] [Type I (PM), pozzolan-modified portland] [Type I (SM), slag-modified portland] cement.

B. Normal-Weight Aggregates: ASTM C 33, [Class 5S] [Class 5M] [Class 1N] coarse aggregate or better, graded. Provide aggregates from single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials].

C. Normal-Weight Aggregates: ASTM C 33, complying with building code. Provide aggregates from a single source. All aggregates shall be free of materials with deleterious reactivity to alkali in cement when tested in accordance with ASTM C 289.
   1. Comply with CBC section 1903A.3.
   2. Maximum Coarse-Aggregate Size: 3/4 inch nominal. Maximum size shall also not be larger than 1/4 of the narrowest dimension between forms, 1/3 the depth of slab nor more than 3/4 of the minimum clear spacing between individual reinforcing bars.
      a. Gradation: Uniformly graded.
      b. Source: Reliance, San Gabriel, or Carrol Canyon

D. Normal-Weight Fine Aggregate: ASTM C 33 or ASTM C 144, manufactured or natural sand, from same source for Project, free of materials with deleterious reactivity to alkali in cement and free of materials which may cause staining and light in color
   1. Source: Reliance, Fosters or Corona.
   2. Color to be white to light with no dark material.

E. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations.

2.04 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Shrinkage-Reducing Admixture: Commercially formulated, shrinkage inhibitor capable of reducing initial shrinkage by 80% and long-term shrinkage by 50%. Provide product suitable for use with either air-entrained or non-air-entrained concrete as appropriate to structural member and project location.
   1. Products: Subject to compliance with requirements, provide one of the following(as required):
      a. Euclid Chemical Company (The), an RPM company; EUCON SRA, SRA+.
      b. Grace Construction Products, W. R. Grace & Co.; Eclipse Floor, Eclipse Plus.
      c. Sika Corporation; Control 40.

2.05 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Clear, Waterborne (Non-Colored Concrete): Provide products complying with ASTM C 309, Type 1, Class B, 18 to 25 percent solids, certified by curing compound manufacturer to not interfere with bonding of sealers, with no glossy finish and compatible with specified sealer. Provide products with not more than 100g/L volatile organic content.
   1. Products: Subject to compliance with requirements.

D. Clear, Waterborne (Colored Concrete): Provide products that are acceptable to concrete color pigment manufacturer complying with ASTM C 309, Type 1, Class B, 18 to 25 percent solids, certified by curing compound manufacturer to not interfere with bonding of sealers with no glossy finish and compatible with specified sealer. Provide products with not more than 100g/L volatile organic content.
   1. Products: Subject to compliance with requirements.

E. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
   1. For integrally colored concrete, curing compound shall be approved by color pigment manufacturer.
   2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

2.06 SEALERS AND WATER REPELLENTS

A. Penetrating Liquid Floor and Horizontal Surface Treatment (Sealer): Clear, chemically reactive, water-based lithium quartz water-based lithium materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. Materials shall be compatible with concrete admixtures and shall be recommended by manufacturer for intended use. Provide products with 0g/L volatile organic content.
   1. Products: Subject to compliance with requirements, provide one of the following:

a. Sinak Corporation; Concrete Sealer HLQ 125.

B. Penetrating Liquid Wall and Vertical Surface Treatment (Repellent): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. Materials shall be compatible with concrete admixtures and shall be recommended by manufacturer for intended use. Provide products with less than 100g/L volatile organic content.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Rainguard International; Microseal(For use with VandlGuardTEN Anti-graffiti coating)

2.07 **ANTI-GRAFFITI COATING**

A. Refer to Section 099620 Permanent Non-Sacrificial Anti-Graffiti Coating for product and specific sealer.
1. Compatible sealer to be applied prior to use of Anti-graffiti coating.

2.08 JOINT DEVICES, FILLER MATERIALS AND OTHER ACCESSORY PRODUCTS

A. Joint Filler at Exterior Sealed Joints: ASTM D 1751
1. 1/4" asphalt-saturated cellulosic fiber.
2. Lightweight, nonstaining, polyethylene closed cell expansion joint filler
a. Deck-O-Foam as manufactured by W.R.Meadows, Hampshire, Ill.
3. Exterior Expansion- and Isolation-Joint-Filler Strips: See Division 32 Section "Concrete Paving Joint Sealants" for sealants for exterior joints at concrete pavements.

2.09 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of cast-in-place architectural site concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.
2. Proportioning:
a. The proportioning of ingredients shall be such that the concrete can be readily worked into forms and around reinforcement under the conditions of placement to be used, without segregation or excessive bleeding.
b. When proportioning by weight of loose, dry material, 94 pounds of cement shall be considered 1 cubic foot.
c. Fine aggregate volume shall be at least 35 percent, with a maximum of 50 percent, of the sum of the separate fine and coarse aggregate volumes.
d. Total water content shall not exceed 35 gallons per cubic yard of concrete.
e. Weighing equipment shall be accurate within 1 pound and shall be adjustable for varying aggregate moisture content.
f. A beam auxiliary shall register any part of the last 100 pounds of each aggregate. The aggregate hopper shall have a volume adjustment.
3. Prepare compressive strength data for both 7-day and 28-day strengths.
a. The 7-day compressive strength shall be at least 60 percent of the required 28- day strength.
b. The 28-day compressive strength shall be as indicated.
4. Provide drying shrinkage test data at 28 days, from not less than 3 test specimens.

B. Cementitious Materials-General: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, by not more than 5 percent. Per ACI 301 limits for concrete exposed to de-icing chemicals, limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash: 0-5 percent.
2. Combined Fly Ash and Pozzolan: 0-5 percent.
3. Ground Granulated Blast-Furnace Slag: 0-5 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 0-5 percent.
5. Silica Fume: 0-5 percent.
6. Combined Fly Ash, Pozzolans, and Silica Fume: 0-5 percent with fly ash or pozzolans not exceeding 0-5 percent and silica fume not exceeding 5 percent.

C. Proportion concrete mixtures as follows:
   1. Minimum Compressive Strength (28 Days):
      a. 3000 psi for pedestrian paving areas.
      b. 4000 psi for vehicular paving areas
   2. Maximum Water-Cementitious Materials Ratio: 0.50-0.60.
   3. Slump Limit: 4 inches, plus or minus 1 inch, unless indicated otherwise.
   4. Slump Limit (High-Range Water-reducing Admixture): 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture, plus or minus 1 inch, unless indicated otherwise.
   5. Slump Limit (Plasticizing Admixture): 8 inches for concrete with verified slump of 2 to 4 inches before adding plasticizing admixture, plus or minus 1 inch, if required/unless indicated otherwise.

D. Air Content, Exterior Exposed Concrete: Provide the following air entrainment for all exposed concrete with a weathering probability of severe or moderate per CBC figure 1904.2.2/1904A.2.2.
   1. Provide air entrainment of 6.0 percent, plus or minus 1.5 percent at point of delivery for 1-inch and 3/4-inchnominal maximum aggregate size, unless indicated otherwise.

E. Slump Limit: [4 inches (100 mm)] for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture], plus or minus 1 inch (25 mm), unless otherwise indicated.

F. Cementitious Materials: For cast-in-place architectural site concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements.[Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.]
   1. Limit water-soluble, chloride-ion content in hardened concrete to [0.06] [0.15] [0.30] [1.00] percent by weight of cement.

G. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement. Limit total chloride-ion content in hardened concrete to 0.10 percent by weight of concrete when tested per AASHTO T 260 potentiometric titration.
   2. Limit "drying shrinkage" after 28 days of curing hardened concrete to 0.045 percent of the original concrete volume.
   3. Admixtures: Admixtures may only be used if they are incorporated into the accepted concrete mix designs. Use admixtures according to manufacturer's written instructions.
      a. Use [water-reducing] [high-range water-reducing] [or] [plasticizing] admixture in concrete, as required, for placement and workability.
      b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
      c. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
      d. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

H. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with accepted mockup.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
   1. Splices: Do not splice bars, unless indicated on the Drawings.
   2. Staggered Splices: Stagger splices such that not more than one-half of the reinforcing bars are spliced at any location.

2.11 CONCRETE MIXING

A. Ready-Mixed Architectural Site Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M [and ASTM C 1116/1116M] and furnish batch ticket information.
   1. Clean equipment used to mix and deliver cast-in-place architectural site concrete to prevent contamination from other concrete.
   2. When air temperature is between 85 and 90 deg. F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg. F, reduce mixing and delivery time to 60 minutes.

B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 FORMWORK

A. General: Comply with the following, unless otherwise indicated:
   1. Conform to ACI 318, ACI 347 and CBC Section 1906A.

B. Structural Loads: Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

C. Geometry: Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. Provide for necessary openings, inserts, anchorages, and other features indicated or required. Properly locate all elements.
   1. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
      a. Class A, 1/16 or 1/8 inch for smooth-formed finished surfaces.
      b. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Form Joints: Minimize form joints and make forms watertight to prevent leakage of concrete mortar. Locate form joints at exposed concrete symmetrically about center of panel and aligned with reveals, unless otherwise indicated. Align joints symmetrically at exposed conditions.
   1. Seal penetrations at form ties with form joint sealant to prevent cement paste leakage.
   2. Provide custom form boards as required to align with reveals.

E. Removal: Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where dismantling or stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

3.02 EARTH FORMS

A. General: Unless indicated, placement of concrete directly against soil or earth (casting "neat") shall not be permitted only with the prior approval of the Structural Engineer of Record. Concrete placed directly against earth shall require a minimum increase in concrete thickness of 1" at vertical faces. For example, footings shall be 2" wider than indicated if both vertical faces are cast against earth.

B. Trimming and Cleaning: Hand trim sides and bottoms of soil forms and trenches. Remove loose soil, exposing undisturbed native soil, and prior to placing concrete.

3.03 CONSTRUCTED FORMWORK

A. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

B. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

C. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

D. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

E. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

F. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

G. Provide bracing and shores to ensure stability of formwork and accommodate all loads. Use form ties of sufficient strength and in sufficient quantities to prevent formwork spreading. Maintain principal shores to support concrete until required strength is achieved.

3.04 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install embedded accessories level, true-to-line and plumb in accordance with manufacturer's instructions.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   3. Provide reveals around embedded items such as light fixtures as shown on Drawings.

3.05 OPENINGS, DEPRESSIONS, RECESSES AND CHASES

A. Size and locate formed openings, depressions, recesses and chases to accommodate products to be applied to, built-into and/or pass-through concrete Work. Coordinate size, location and placement of inserts, embedded products, openings and recesses with Work of other sections. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.06 FORM RELEASE AGENTS

A. General: Provide either form materials with factory-applied non-absorptive liner or field-applied form coating. Field-applied coating shall be non-staining.
   1. Non-absorptive Liner: Rust on steel form surfaces is not acceptable.
   2. Field Applied Coating: Comply with manufacturer's written instructions. Obtain written acceptance of form release agent from integral colored concrete pigment manufacturer.
      a. Reapply coating to thoroughly cleaned and reconditioned formwork before each use.
      b. Verify compatibility of release agents with integrally-colored concrete and all subsequently applied curing compounds, coatings, applied finishes, etc. Do not apply release agent if items are non-compatible.
      c. Do not apply release agent where decorative wood graining is intended for concrete surface. Leave form face dry.

3.07 CONCRETE SURFACE RETARDERS

A. Coat contact surfaces of forms with surface retarder, according to manufacturer's written instructions, before placing reinforcement.

3.08 FORM LINERS

A. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

3.09 REMOVING AND REUSING FORMS

A. General: Formwork for sides of walls, steps, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg. F for 72 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Schedule form removal to maintain surface appearance that matches accepted mockups.
   2. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength, but not less than 21 days after pour.
   3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
   4. All formwork is to be new specifically purchased for this project.

B. Clean and repair surfaces of forms to be reused in the Work in non-exposed areas. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.10 STEEL REINFORCEMENT

A. General: Place and secure reinforcement as indicated. Comply with CRSI publications "Manual of Standard Practice" and "Placing Reinforcing Bars".
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
   2. Do not bend bars more than once.

3. Do not bend or straighten reinforcement in a manner injurious to the material, such as heating.
4. Do not use bars with kinks or bends not indicated.
5. Do not use bars with reduced cross-section due to corrosion or other cause.
6. Remove and replace all defective bars.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Space reinforcement as indicated. If not indicated, maintain clear spacing of not less than the bar diameter, 1-inch, or 1-1/3 times the maximum aggregate size, whichever is greater. Where parallel reinforcing is placed in more than one horizontal layer, place as many bars as possible in the outboard layer, maintaining the required lateral clearances and spacing's. Place bars in the inboard layer in direct vertical alignment with the bars of the outboard layer. Maintain not less than 1-inch or the maximum bar diameter in the inboard/outboard layers, whichever is greater, clear space between vertically stacked bars.

D. Accurately position, support, and secure reinforcement against displacement.
1. Maintain reinforcing steel positions during placement operations. Properly reset any reinforcement that is displaced by runways, workmen and other causes.

E. Locate and support reinforcement with bar supports to maintain minimum concrete cover as indicated or as required by ACI 318.

F. Do not tack weld crossing reinforcing bars.
1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

G. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

H. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.11 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction or Cold Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Locate horizontal joints in walls and columns as indicated.
3. Space vertical joints in walls as indicated and as may be directed by the Architect. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
6. Align joints with reveals indicated. Provide custom cut form boards as required.
7. Do not place expansion material at cold joints.

C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, walls and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.12 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, form-release agent, surface retarders, reinforcement, and embedded items is complete and that required inspections have been performed.
   1. Provide protective coatings, coverings and masking's to protect adjacent Work.
   2. Provide temporary runways and other appropriate equipment as necessary to access Work area and to avoid soiling or damage to existing Work.
   3. Prevent run-off of concrete hydration water and water polluted by agents and chemicals from soiling existing surfaces or contaminating landscape areas.

B. Do not add water to concrete during delivery, at Project site, or during placement.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
   2. If indicated in mix design accepted by the Architect, water added to concrete shall be observed by the Project Inspector, and shall be recorded on the delivery ticket.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. No visible cold joints or lift lines are acceptable in the completed work.
   3. Consolidate placed concrete with mechanical vibrating equipment according to ACI 303.1.
   4. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
   5. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   6. Maintain reinforcement in position on chairs during concrete placement.
   7. Screed slab surfaces with a straightedge and strike off to correct elevations.
   8. Slope surfaces uniformly to drains where required.
   9. Begin initial floating using bull floats or derbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg. F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
4. Do not use chemical accelerators unless otherwise specified and accepted in design mixtures.

F. Hot-Weather Placement: Comply with ACI 305R and as follows:
1. Maintain concrete temperature below 90 deg. F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.13 FINISHES, GENERAL

A. Architectural Site Concrete Finishes: Match Architect's design reference sample, identified and described as indicated, to satisfaction of Architect.

B. Architectural Site Concrete Finishes: Match accepted mockups to satisfaction of Architect.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

D. Maintain uniformity of special finishes over construction joints unless otherwise indicated.

3.14 EXPOSED-AGGREGATE FINISHES

A. Retarder Finish: Remove formwork without damaging edges or reveals.
1. Ensure finish is even and no honeycombing or discoloration is apparent
2. Edges shall net be chipped or spalled

3.15 SKATEBOARD DETERRENTS

A. General: Install skateboard deterrents in epoxy adhesive supplied by manufacturer, in accordance with manufacturer's instructions.
1. Install as shown. If not shown, install in symmetrical fashion on all formed edges within 4 feet (1.22 m) of adjacent grade, at intervals not to exceed 3 feet (1.1 m) O.C.

3.16 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 305R for hot-weather protection during curing.

B. Begin curing cast-in-place architectural site concrete immediately after removing forms from concrete or after applying as-cast formed finishes to concrete, consistent with mockup preparation. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
1. Moisture Curing: Keep exposed surfaces of cast-in-place architectural site concrete continuously moist for no fewer than seven days with the following materials:
a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for no fewer than seven days. Immediately repair any holes or tears during curing period; use cover material and waterproof tape.
3. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the CBC and ACI 301.
   1. Comply with the requirements of Division 01 Section "Quality Control-DSA".

B. Inspections:
   1. Steel reinforcement placement.
   2. Steel reinforcement welding.
   3. Headed bolts and studs.
   4. Verification of use of required design mixture.
   5. Structural concrete placement, including conveying and depositing.
   6. Curing procedures and maintenance of curing temperature.
   7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg. F and below and when 90 deg. F and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31/C 31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
      b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. Test one set of two field-cured specimens at 7 days and reserve one set of two specimens for testing at 56 days.
      b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.18 DEFECTIVE CONCRETE

A. The following list includes, but is not limited to; concrete that will be deemed to be defective and non-conforming. All such concrete shall be removed and replaced with Work complying with the requirements of the Contract:
   1. Concrete not formed as indicated, not true to alignment indicated, not plumb where intended, not level where intended, not true to level or elevation intended.
   2. Concrete voided or honeycombed, including voids and honeycombs that have been cut, resurfaced or filled without prior approval of the Architect.
   3. Concrete with exposed reinforcement.
   4. Concrete with inadequate cover over reinforcement.
   5. Concrete with embedded foreign objects and debris, including sawdust, wood or metal shavings, nails, cans, trash, etc.
   6. Concrete that does not visually match the accepted mockups [or the designated design reference sample].
   7. Other non-conforming work.

B. All concrete deemed to be defective by the Architect or in non-conformance with the contract documents is to be removed and replaced from expansion joint or cold joint to expansion joint or cold joint at no cost to the owner. Repair defective concrete as directed by the Architect, at no cost to the Owner.

3.19 SEALERS AND REPELLENTS

A. General: Uniformly apply a continuous sealing coat of sealers or repellents to all exposed surfaces of architectural site concrete by power spray or roller according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days old.

B. Penetrating Liquid Floor and Horizontal Surface Treatment (Sealer): Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

C. Penetrating Liquid Wall and Vertical Surface Treatment (Sealer/Repellent): Prepare, apply, and finish penetrating liquid repellent treatment according to manufacturer's written instructions.

3.20 **ANTI-GRAFFITI COATING**

A. Refer to Section 099620 Permanante Non-Sacrificial Anti-Graffiti Coating.

B. Apply to all exposed architectual site concrete.

C. Apply compatilble sealer to exposed architectural site concrete prior to installation of Anti-Graffiti coating.

3.21 REPAIRS, PROTECTION, AND CLEANING

A. Patching or sacking of damaged or defective concrete as a determined by the Architect is not permitted. Remove and replace all damaged or defective concrete from joint to joint. Remove/Repair and cure damaged or defective finished surfaces of cast-in-place architectural site concrete when accepted by Architect. Match repairs to color, texture, and for any replaced work/uniformity of surrounding surfaces and to repairs on approved mockups.

B. Remove and replace cast-in-place architectural site concrete that does not match mockups accepted by Architect.

C. Protect corners, edges, and surfaces of cast-in-place architectural site concrete from damage; use guards and barricades.

D. Protect cast-in-place architectural site concrete from staining, laitance, and contamination during remainder of construction period.

E. Clean cast-in-place architectural site concrete surfaces after finish treatment to remove stains, markings, dust, and debris.

F. Wash and rinse surfaces according to concrete finish applicator's written instructions. Protect other Work from staining or damage due to cleaning operations.
1. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural site concrete finishes.

END OF SECTION

SECTION 328000
IRRIGATION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
B. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
C. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
D. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications; 2022.
E. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2020.
F. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
G. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2020.
H. ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2023.
I. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.
J. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014 (Reapproved 2021).
K. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

1.02 SUMMARY

A. Section includes trenching, pipe and fittings, valves, sprinkler heads, and control system.
B. Related Sections:
    1. Section 01 33 00 – Submittals and Substitutions
    2. Section 01 35 00 – Special Project Procedures
    3. Section 01 42 19 – Regulatory Requirements
    4. Section 01 77 00 – Closeout Procedures
    5. Section 33 10 00 – Water Distribution
    6. Section 32 94 00 – Tree Protection and Trimming
    7. Section 32 90 00 – Exterior Plants
    8. Section 32 92 19 – Seeding and Soil Supplements
    9. Section 32 92 23 – Sodding

1.03 SYSTEM DESCRIPTION

A. Electric solenoid controlled underground irrigation system.
B. Source Power: 120 volt, 3 phase.
C. Low Voltage Controls: 24 volt.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00 - Submittals.

B. Product Data: Provide component, control system and wiring diagrams, and warranties.

C. Samples: Provide one sprinkler head of each type, with housing. Accepted samples may not be used in the Work.

D. Material List: Complete list of all materials to be used on the job before starting job. Within five (5) days after award of the Contract, and before any materials of this section have been delivered to the job site, submit to the Landscape Architect:
   1. A complete material list of al items proposed to be furnished and installed under this section including but not limited to supplier, and cut sheets, colored copies spiral bound unless otherwise noted. PDF's emailed to all parties shall be accepted with prior approval by construction management/ design team.
   2. The manufacturer's recommended methods of installation which, when recommended for approval by the Landscape Architect, shall become the basis for review and accepting or rejecting actual installation methods used on the work when not otherwise specified or detailed.

E. Should the Contractor propose to use materials or equipment other than those listed on the plans, he/she shall submit samples of the make and type proposed. Samples shall be submitted a sufficient time in advance of the start of construction to allow a period of not less than seven (7) days for testing and recommended approval. Substitution of any product, material, or equipment without prior, written, recommended approval will not be permitted.

1.05 PROJECT RECORD DOCUMENTS

A. Conform to the requirements of Section 01 77 20.

B. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and/or the actual final installed locations of all required components as shown below. The record drawings shall be prepared to the satisfaction of the District and the Landscape Architect.

C. All record drawings shall be prepared using AutoCAD 2016 drafting software and the original irrigation drawings as a base. Manual drafted record drawings shall be acceptable in addition to the AutoCAD Version. The Contractor may obtain digital base files from the Landscape Architect or District's authorized representative. In the event the Contractor is unable to provide the AutoCAD drafting necessary for the record drawings, consult Landscape Architect or District's Representative for Services at a fee.

D. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and Pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.
   1. Show locations and depths of the following items:
   2. Point of connection (including water POC, backflow devices, master control valves, flow sensors, Booster Pumps, etc.)
   3. Routing of sprinkler pressure mainlines (dimensions shown at a maximum of 100 feet along routing)
   4. Isolation valves
   5. Automatic remote control valves (indicate station number and size)

6. Quick coupling valves
7. Drip air relief and flush valves
8. Routing of control wires where separate from irrigation mainline
9. Irrigation controllers (indicate controller number and station count)

E. Prior to scheduling a walk through for Substantial Completion, provide a record set of field drawings as described above to the District for review. After review, the District will return the set to the field foreman requesting further information or will notify that the record set of field drawings are complete. After approval from the District, a walk through for Substantial Completion may be scheduled. Prior to scheduling the final walk through, the final set of irrigation record drawings shall be professionally drafted. Contractor is responsible for delivering the final set of record drawings to the District prior to initiating the maintenance period. The Contractor shall also provide record drawing information on a digital AutoCAD Release 2016 drawing file. All digital files shall be provided on a compact disc (CD) clearly marked with the project name, file descriptions and date.

1.06 OPERATION AND MAINTENANCE DATA

A. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.

B. Provide irrigation schedule indicating length of run time for each valve, following District direction for length of time scheduled for each valve.

C. Controller Charts:
1. The District Representative must approve record drawings before controller charts are prepared.
2. Provide one control chart for each control installed and one control chart to the ground supervisor.
3. The chart shall show the area controlled by the automatic control.
4. The chart shall be based on a record drawing, reduced to the maximum size that will fit inside controller housing (printed on two sides if required for readability).
5. The chart shall be a black-line print with different colors to indicate areas of coverage for each station, using pastel or transparent colors.
6. When completed and approved, hermetically seal and laminate the chart between two pieces of plastic (thickness of each piece being minimum 20 mils.
7. These charts must be completed and approved prior to final acceptance of the irrigation system.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum 10 years documented experience.

1.08 REGULATORY REQUIREMENTS

A. Perform Work in accordance with the State of California Plumbing Code.

B. Products listed by UL or other agency acceptable to authority having jurisdiction; National Electric Code.

1.09 PRE-CONSTRUCTION CONFERENCE

A. Shall be convened one week prior to the commencement of the Work.

1.10 FIELD MEASUREMENTS

A. Verify all field measurements and easement as indicated on drawings and prepare shop drawings per Section 01340. Notify the Facilities Grounds Coordinator.

1.11 EXTRA MATERIALS

A. Furnish the following extra components:
   1. Two sprinkler heads of each type and size specified and installed.
   2. Two sets of wrenches for disassembling and adjusting of each type of head installed.
   3. Two valve handles for the specified ball valves.
   4. One operating key shall be furnished for each five (or less) gate valve installed.
   5. Two keys for valve boxes (steel locking lids).
   6. One quick coupler key for each quick coupler, matching size, furnished under this contract.
   7. Two adjustment screw drivers for each head type.
   8. One remote hand-held Pro-Max radio transmitter and receiver, Model # PROMAX-UA for the new or existing Rain Master Evolution DX 2 control.
   9. Two Christy, #LFG 160, 0-160 PSI liquid filled pressure gauges.

B. Manufacturer cut sheet and operation manual for controllers.

C. Two individually bound "Operating and Maintenance Manuals" detailing operation and maintenance requirements for irrigation systems. Include descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate and maintain the equipment.

D. Provide the following in each manual:
   1. Index sheet, stating Irrigation Contractor’s name, address, telephone number and name of person to contact.
   2. Duration of guarantee period, including all manufacturer’s guarantee or warranties.
   3. Equipment list providing the following for each item;
      a. Manufacturer's name.
      b. Make and model numbers.
      c. Name and address of local manufacturer’s representative.
      d. Spare parts list detail.
      e. Detailed operating and maintenance instructions for major equipment.

E. The above-mentioned items shall be turned over to the Owner at the conclusion of the project, prior to final payment.

F. In addition to the above-mentioned maintenance manuals, provide the Owner's maintenance personnel with instructions for major equipment and show evidence in writing to the Landscape Architect at the conclusion of the project that this service has been provided.

G. Two (2) operator and service manuals and information pages for all equipment used shall be furnished to the Owner. Manuals may be loose leaf and should show drawings or exploded views of equipment and catalog number. Operating instructions for all equipment shall be furnished.

1.12 WARRANTY

A. Sprinkler irrigation system warranty shall be according to the following form and in addition to the form found in Section 01 77 40. The general and supplementary conditions of these specifications shall be filed with the Owner or his representative prior to acceptance of the irrigation system.

B. Manufacturer warranties do not relieve the Contractor of his liability under the warranty. Such warranties only supplement the warranty.

C. Include a copy of the warranty form in the Operations and Maintenance Manual.

D. The following warranty form shall be typed on Contractor's letterhead and shall be submitted in addition to the form found in Section 01 77 40:
   1. WARRANTY FOR IRRIGATION SYSTEM
   2. We hereby warranty that the irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear, unusual abuse or neglect excepted. We agree to repair or replace any defects in material or workmanship which may develop during or prior of FIVE 5 YEARS from the date of acceptance and also to repair or replace any damage resulting from the repairing or replacing of such defects, at no additional cost to the Owner. We will perform such repairs or replacements within three days after receipt of written notice. In the event of our failure to perform such repairs or replacement within a reasonable time after receipt of written notice from Owner, we authorize the Owner to proceed to complete said repairs or replacements at our expense and we will pay the costs and charges therefore upon demand.
   3. PROJECT:
   4. CONTRACTOR:
   5. ADDRESS:
   6. PHONE NO.:
   7. BY:
   8. DATE OF ACCEPTANCE:
   9. BY:

1.13 TEMPORARY REPAIRS

A. The District reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the District will not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

A. Manufacturers:
   1. Spears Manufacturing (PVC fittings).
   2. Harco 80 Series (ductile iron fittings).
   3. Harco, Leemco or (ductile iron joint restraints)
   4. Pacific Plastics (plastic pipe).
   5. SALCO (1/2” Flexible Sch 80 PVC pipe and Male adapters for drip emitters).
   6. I.P.S. weld on (solvent weld cement & primer).

B. General Piping:
   1. Manufacture from virgin polyvinyl chloride compound in accord with ASTM D1784 or ASTM D2241, cell classification 12454B; hydrostatic design stress rating not less than 2,000 psi.
   2. PVC in accordance with ASTM D1785, D2241, D2672, D3139 Type 1, Grade 1
   3. Mainline shall be determined as follows:
      a. 1-1/2" and Smaller shall be JM Eagle Pipe Sch. 40 PVC, 1120/1220 Streamline solvent weld.

b. 2” to 3” shall be JM Eagle Pipe CL 315 solvent weld. Solvent weld type PVC fittings shall be Schedule 80 PVC and have concrete thrusts blocks at all changes in direction
c. 4" and Larger shall be JM Eagle Pipe Class 200 DR 14 rubber gasket type PVC or equal; Pipe Stiffness 814 with Leemco fittings and joint restraints and concrete thrust blocks at every change in directions.

4. All mainline shall have thrust blocks. All ends, corners, etc. on mainline shall have a thrust block at every change in direction.
5. Lateral Lines shall be JM Eagle Pipe 1120/1220 Sch. 40 Streamline solvent weld.
6. All pipe shall be continuously marked with: Manufacturers name, nominal size, PVC type, pressure rating, SDR, NSF seal, and date of extrusion.
7. Non-pressure Lateral Lines:
   a. Non-Pressure Lateral Lines: (downstream of electric remote-control valve) PVC Schedule 40, conforming to ASTM D1785-83.
   b. Fittings: Standard weight, Schedule 40, injection molded PVC, complying with ASTM D1784 and D2466, cell classification 12454-B.
      1) Threads - Injection molded type (where required).
      2) Tees and Ells-side gated.
      3) Threaded Nipples: ASTM D2464, Schedule 80 with molded threads.
      4) Joint Cement and Primer: Type as recommended by manufacturer of pipe and fittings.
8. Pressure supply line from point of connection to backflow prevention unit as required by City State and Local Code.
9. Solvent Weld Pressure Supply Line: (3/4” through 1 1/2”) SCH 40 Solvent Weld PVC Pipe (2” through 3”) class 315 solvent weld PVC with concrete thrust blocks at all ends, corners, etc., and/or (4” through 6”) Class 200 Gasketed PVC Pipe with Leemco joint restraints or equal.
10. Non-pressure lines: (downstream of electric remote control valve) PVC Schedule 40, conforming to ASTM D1785-83.

C. Plastic Pipe Fittings (solvent weld type): Manufactured from virgin polyvinyl chloride compound. Fittings: Standard weight, Schedule 40, injection molded PVC for (3/4” through 2”). Fittings: Standard weight, Schedule 80, injection molded for (2 ½” through 3”).

D. Ductile Iron Gasket Fitting: Grade 65-45-12 inch accordance with ASTM F477. The fittings shall be HARCO DEEP BELL as manufactured by the Harrington Corporation of Lynchburg, VA. (3” through 6”).

E. PVC Gasketed Coupling: Class 200, SDR 21, ASTM D1784. The fittings shall be HARCO as manufactured by the Harrington Corporation of Lynchburg, VA. Note: Only PVC Gasketed Couplings shall be permitted. All other Gasketed Fittings shall be Ductile Iron.

F. Sleeving: Sleeving for pressure supply line (up to 3” size) and non-pressure supply lines shall be twice the nominal size of the pipe. Sleeving for pressure supply lines (4” size and larger) shall be two and one half (2 ½) times the nominal size of the pipe to accommodate any joints and joint restraints inside the sleeve.

G. Copper Tubing: ASTM B88 Type K. Fittings: Type and style of connection to match pipe. Fittings: Wrought copper, solder joint type.

H. Brass Pipe: Seamless, 85% red brass, iron pipe sized, threaded. Fittings: medium brass 250 psi, screwed, A.S.A. B 16.17 and F S WW-P-460.

I. Flow sensing cable and master valve wires shall be installed in the same conduit and apart from all other wires.

J. Joint Cement: I.P.S. Weld-ON Product: 711 PVC, Red Hot blue glue shall not be allowed unless prior approval by district and landscape Architect is made in advance and only for non-pressure lateral lines or conduits.

K. Joint Primer: I.P.S. Weld-ON Product: P-70

L. Mainline pipe thread sealant:
   1. Plastic to metal fittings: Teflon tape (overlapping wrap on male threads) or 100 % virgin Teflon pipe dope (coat male and female parts).
   2. Metal to metal fittings: Permatex 51 D (apply a thick coat to male and female parts).

2.02 FITTINGS

A. Mainline
   1. Fittings for Mainline pipe 1” to 3” shall be Schedule 80 PVC Solvent Weld ASTM D2464.
   2. Leemco restraint systems for Mainline pipe 4” and Larger– ductile Iron restrain system with slanted bell fittings.

B. Reducer tees will be used in cases of pipe size reduction. Bushing will only be allowed in cases of reduction where such a reducer tee is not manufactured.

C. Rigid PVC Nipples: ASTM D1785, Schedule 80, Type 1, molded threads.

D. Schedule 40 PVC street ells.

E. Brass: Red brass conforming to Federal Specification #WW-P-351. Schedule 40 threaded nipple stock, tees, ells, and unions.
   1. Brass pipe shall be 85% red brass, American National Standard Institute (ANSI), Schedule 40 screwed pipe.
   2. Fitting shall be medium brass, screwed 125-pound class.

F. Copper – Wrought solder-joints.
   1. Pipe: Type K, hard tempered.
   2. Fittings: Wrought copper, solder joint type.
   3. Joints shall be soldered with silver solder, 45% silver, 15% copper, 16% zinc, 24% cadmium, solidus at 1125 Degrees F. and liquidus at 1145 Degrees F.

G. Cast Copper Flange Fittings conforming to ASTM B584/ANSI B16.18, max pressure rating: 300psi, Temp range: 100 degree to 250 degree.

H. Ductile Iron Flanged Fittings: ASTM A536-ANSI/AWWA C110/A21.10, UL and FM requirements, pressure rating 250 psi rating for 1”-48” sizes and 150psi rating for 54” – 64”.

2.03 FITTING CONNECTION

A. Solvent Cement: ASTM D2564 for PVC Pipe and fittings.

B. Use heavy body cement for Sch 80 fittings. Follow ASTM procedures for all pipe welding and installation. Use Teflon Tape at all fittings.

C. PVC Primer and Glue: Use in all cases as recommended by pipe and fittings manufacturer, including both pressure supply lines and non-pressure Lateral lines.
   1. IPS Weld - On P - 70 primer
   2. IPS Weld - On 2711 (gray) cement

D. PVC to metal joints shall be made with PVC Schedule 80 threaded fittings into galvanize with female adapter to PVC pipe. The PVC fitting shall be hand tightened, plus one turn with strap wrench. Joint compound shall be IPS weld on Teflon pipe joint compound or equal.

E. Metal-to-Metal joints: graphite and oil lubricant or Teflon paste on male threads only.

2.04 SLEEVES AND CONDUIT

A. 1-1/2” and Smaller shall be Sch. 40

B. 2” and 2-1/2” shall be Sch.40

C. 3” and Larger shall be Sch. 40

2.05 OUTLETS

A. Manufacturers:
   1. The District standard is Rain Bird, except for except for artificial turf. The standard for drip is Rainbird PCT or RWS-B-C. The standard for artificial turf is Toro TS Series Rotor or Hunter ST System rotors. No deviations or substitutions are permitted.
      a. Sprinklers located on the perimeter of artificial turf areas: pop up Toro TS series or Hunter ST System.
      b. Sprinklers located in large turf areas: Falcon 6504 Series: pop up Rain Bird Falcon Stainless Steel risers.
      c. Sprinklers located in medium turf areas: pop up: Rain Bird 5004 Plus Series, with Stainless steel risers.
      d. Sprinklers located in small turf areas: pop up Rain Bird 1804 Series or RD 1800 Series.
      e. Sprinklers located in small shrub areas: 12” pop up Rain Bird 1812 Series or RD 1800 Series.
      f. Sprinklers located in medium/large sloped areas: 12” pop up Rain Bird 5012 Series.
      g. Sprinklers located in shrub areas: drip emitters Rainbird PCT.
      h. Sprinklers located in slope areas: Rainbird MPR or VAN.
      i. Rainbird RWS-B-C 1402 inch a sch. 40 PVC Perforated pipe made in the USA with a Poly-Dome drain Cover.

2.06 CONTROL

A. Manufacturers:
   1. Rainbird ESP-LXME/SAT in top entry stainless steel enclosure. Reference irrigation plan, detail, and legend for station quantity and appropriate model number, including communication board, flow sensing board and Master valve board.

B. Low voltage connections between controller and remote-control valves shall be made with direct burial AWG UF copper wire, manufactured by Paige. Reference irrigation plan, detail, and legend for size and appropriate model number for gauge size (12AWG for common and 14AWG for valves).

C. The irrigation system controller shall be weather-based and self-adjusting to Evapotranspiration.

D. The controller shall operate on a 117 VAC "10% at 60 Hz and be capable of actuating up two 24 VAC, 7 VA, solenoids per station plus a master valve and pump start relay. The Controller output and input shall be protected against severe electrical surge by a 2.0-amp self-retting fuse. The Controller shall measure 14.5” L x 12.5” W x 4.75” D.

E. The controller shall communicate two ways – from the on-site controller(s) to a central web server and from the central web server to the on-site controller(s).

F. The controller shall have 16-48 stations in 8 station increments, each capable of operating single stations or all stations from 1-255 minutes in 1-minute increments. The minimum configuration shall be 16 stations.

G. The on-site controller(s) access shall include, but not limited to, land-line telephone Analog, wireless via the GSM network, and power-line through 110-volt power.

H. The central servers shall be located in two geographically different states of the United States to ensure backup protection against different common natural disasters that may occur in each of these regions.

I. The controller shall be access local weather via the internet to a central server. The local weather source shall be monitored 24 hours a day, 7 days week.

J. The central server shall be capable of computing a custom schedule on a station-by-station basis for each controller using local weather and irrigation scheduling algorithms that are based on detailed landscape profile for each station. The landscape profile shall be entered via a web interface that enables the user to select six specific descriptive inputs for each station, including sprinkler or drip type, plant type, soil type, sun/shade condition, slope, and precipitation rate.

K. The custom schedule(s) shall be updated daily and communicated to the on-site controller(s).

L. Current detection - The controller will have the ability to detect if a valve solenoid is connected and current is regular or if there is a current problem, either (1) not connected or burned open which has low current reading or (2) a "short" condition which has a high current reading. The controller display panel will indicate OK (regular current), OC (open circuit - not connected) or SH (short). The controller will do the current test each time the controller runs and if a problem is detected an "alert" will be sent via email. This feature may also be used to test valve solenoids at the time of installation.

M. Multiple Valve Operation in Manual Mode - The controller shall have multiple valve operation that will enable a manual test of multiple valves (e.g. stations 1 and 4 or stations 1, 4 and 6) at the time of install to determine if there is adequate pressure to run multiple valves at a time.

N. The on-site controller(s) will execute the schedule(s) in a water window that has been set on the web site.

O. Set-up, monitoring, adjustments will be accomplished from any PC via internet connection with the central server.

P. Standard connections for rain sensor, booster pump, master valve, and flow sensor. Compatible with normally open or normally closed master valves, rain/freeze or wind sensors (users are notified via email when irrigation is blocked or restarted).

Q. Optional flow monitoring service provides mainline break protection, individual station flow monitoring, and leak detection. Features include automatic shut-off in event of mainline break and email alerts for high flow, low flow, no flow, and leak conditions. Compatible with Data Industrial IR Series flow sensors and Bermad 910P or equivalent.

R. The controller shall be capable of retrofitting into select controller brands without the need to re-wire the controller wires to field wires.

S. The controller shall be capable of learning flow parameters by valve through a 3-minute system test operation. The learned flow shall be accepted by user via internet-based access. The Controller shall have station output terminal sized for up to 12-gauge wire.
   1. The Controller shall have an LCD display to provide output verification for station being irrigated.
   2. The Controller shall include chassis-mounted grounding lug for added lightning protection.
   3. The Controller shall include a built-in 120VAC convenience outlet for optional power line communication.
   4. All 24VAC output terminals shall have surge protection rated up to 4KV in accordance with IEC 6100-4-5 standard.
   5. All outputs shall be protected by a 2.0amp self-resetting fuse.
   6. Input power draw shall be 1.0 amp or less at 120VAC.
   7. Each valve station, master valve, and booster pump output terminal shall handle up to two 24VAC solenoids.
   8. The total controller output shall be 2.0 amps and may operate four solenoids including master valve and pump start relay.
   9. The controller shall be supplied with three 1.5V batteries and has the capacity to maintain time and date for several months.

10. The controller shall have non-volatile memory to retain all programming information indefinitely.
11. The controller shall be capable of integrating an optional remote receiver or connector.

2.07 CONTROLLERS: ALL CONTROLLERS SHALL HAVE THE FOLLOWING SPECIFICATIONS AND CAPABILITIES:

A. Station timing: 0 minute to 12 hours
B. Seasonal Adjust: 0% to 300%
C. 4 Independent programs (ABCD).
D. 8 Start Times per program
E. Input required: 120 VAC+- 10%, 60Hz
F. Output: 26.5 VAC 1.9A
G. Power back-up: Lithium coin-cell battery maintains time and date while nonvolatile memory maintains the programming.
H. Multi-valve capacity: Maximum five 24 VAC, 7VA solenoid valves simultaneous operation including master valve, maximum two solenoid valves per station.

2.08 INTERNET BASED FEATURES:

A. Weather-based watering schedules with ET and rain adjustments automatically generated on a daily basis for all stations.
B. The system shall include step-by-step configuration process enabling the system to generate customized watering schedule for each station to optimize water use and minimize runoff.
C. Daily display of both ET (evapotranspiration) and rain data. Water budget adjustable from 50% to 400% in 5% increments on a station-by-station basis.

2.09 IRRIGATION CONTROLLER STAINLESS STEEL ENCLOSURE (WHERE APPLICABLE)

A. The enclosure shall be of a vandal and weather resistant nature manufactured entirely of 304 grade stainless steel. The main housing shall be louvered upper and lower body to allow for crossflow ventilation. A stainless-steel backboard shall be provided for the purpose of mounting electronic and various other types of equipment. The backboard shall be mounted on four stainless steel bolts that will allow for removal of the backboard.
B. The inside door area shall provide adequate storage for plans, operating instructions, and scheduling information.
C. The enclosure door shall have a continuous stainless-steel piano hinge, carriage bolted on one side, and a three-point locking mechanism on the other side. The handle controlling the locking mechanism shall be located at the base of the door and be concealed within the surface of the door. A stainless-steel cam style lock shall be mounted in the door and a provision for a padlock shall be included within the locking mechanism.
D. The enclosure shall be manufactured with a continuous drainage channel which mates with a teardrop shaped, hollow center, water-tight, thermoplastic door seal. The above-described product shall be a NEMA 3R Rain-proof Enclosure as listed by Underwriter Laboratories, Inc.
E. Controller enclosures shall be "Strong Box" manufactured by V.I.T. Products. Inc.

2.10 AUTOMATIC CONTROL VALVES

A. Manufacturers:
   1. 3/4” - 2”, Rain Bird Sprinkler Manufacturing Corp, Model EFB-CP only.
   2. Rainbird PESB for drip systems less than 5 gpm.

B. All automatic control valves (electric) shall be globe, electrically controlled, hydraulically operated, single seat, normally closed, brass or cast iron only with spring loaded, packless diaphragm.

C. The automatic control valves shall be actuated by a normally closed solenoid valve operator using 24 volts, 60-cycle alternating current without diode. The wires in the coil of the solenoid shall be embedded in an epoxy resin. The entire solenoid shall be enclosed in a watertight housing. Valves shall automatically close in event of electrical power failure.

D. All automatic control valves shall have a flow control device for manually adjusting the amount of flow of water through the valve (except for Bermad 3-way solenoid valves and pressure reducing valves). The flow control device shall be adjusted so that the pressure at the nozzle of the sprinkler head farthest from the automatic control valve shall be that as specified in the irrigation legend per plan. The pressure at the sprinkler head shall be measured by means of a pitot tube pressure gauge while the sprinkler head is operating.

E. Automatic control valves shall be as specified on the plans. Reference irrigation plan, detail, and legend for size and appropriate model number.

F. Valve Box and Cover: Rectangular concrete boxes with concrete covers of type and sizes for all valves indicated on drawings. All boxes are to be buried 2 inches below grade as measured to the top of box/lid. Cluster valves in groups to a few centralized locations.

G. Master Valve & Flow Sensor: Bermad 900 Series or approved equal Normally Open master valve with “built in” flow meter. Reference irrigation plan, detail, and legend for size and appropriate model number.

H. Valve identification tags shall be pre-printed, double sided standard yellow tags made of polyurethane with reinforced attachment hole. Lettering shall be hot-stamped with alpha-numeric numbering matching the controller station, a minimum of 1 inch in height. As manufactured by Christy’s or equal. ID.MAX.Y2.PW.017 or ID.MAX.P2.RC009

2.11 ELECTRICAL (LINE VOLTAGE)

A. All line voltage electrical services required for automatic control and other irrigation system equipment noted on drawing shall be provided under this contract.

B. All connections between electrical services and equipment shall be in rigid galvanized electrical conduit or schedule forty rigid grey electrical PVC conduit (18” minimum cover for PVC conduit), with conduit and wiring sizes as required and specified in the NEC.

2.12 ELECTRICAL (LOW VOLTAGE)

A. All control wire shall be of the Underwriter's Laboratory type UF (underground feeder), single conductor, solid copper, plastic insulated, 600 volt rated, for direct burial applications. Maximum conductor operating temperature, 140 degrees Fahrenheit. for both wet and dry locations. Wire composition is as follows:

1. Conductor - The conductors shall be solid annealed uncoated copper meeting the applicable requirements of the latest revisions of A.S.T.M. B-3.
2. Insulation - the insulation shall be colored plastic which meets the test requirements of I.P.C.E.A. (The Insulated Power Cable Engineer's Association) Pub. No. S 61 402, dated July 1961, Section 3.7 for 140 degrees Fahrenheit. polyvinyl chloride insulation. The insulation shall be flame retardant, resistant to fungus, resistant to corrosive fumes, suitable for wet locations and furnish some degree of inherent protections against mechanical abuse. Insulation thickness shall be 47 mils for AWG #14, #12 & #10, and 62 mils for AWG #8.
3. Color Coding - The conductor insulation shall be color coded as follows:
   a. All common ground wire shall be white.
   b. All pilot (valve control) wire shall be black.

4. Wire Connectors
   a. 3m DBY/R Direct Burial Splice Kit, shall splice and effectively moisture seal two or more conductors. The electrical connector shall be a Scotchlok Y. The device shall be installed per manufacturer's instructions and all applicable codes. The device shall be UL Listed as a Wire Connector System For Use With Underground Conductors.
   b. King-6Y yellow 31555
   c. King-2 Dark blue 10222
   d. King-4Y yellow 10444
5. Wire Connections for direct burial shall be "one stop" waterproof wire connectors.
6. All wire for control for valves and pump start relays shall be insulated solid copper conductor of type approved for direct burial. Use color-coded wire for pilot wires, a different color for all valves of each controller, and install per valve manufacturer's specifications and wire chart. Common wire for each controller shall be white with stripe of same color as pilot wires. Extra wires shall be black. A color different from all pilot and extra wires shall be used for master valve and flow sensor wires.

2.13 WIRE SPLICES

A. Conductors shall be installed with no underground splices, unless absolutely necessary and unavoidable. Any and all underground splices that are required to be made, must be approved by the Architect, and shall be placed in a suitable type valve box for easy access.

B. Wire splices on the two conductor cable communication wires shall be made with GPH GDBRY6 3M DBY splice kit or approved equal.

C. Wire splices on the multi-conductor cable communication wires shall be made with Preformed Super Serviseal with Poly-bee sealant (product #8006039).

2.14 QUICK COUPLER VALVES

A. Unless otherwise indicated on the plans, all quick coupling valves shall be one inch in size, self-closing, two-piece body, with vandal proof (lockable) top. Valves shall be constructed of bronze, brass and /or stainless steel. Riser opening thread shall be one inch female IPS. Rain Bird 44 LRC shall be furnished as the District approved Manufacturer and Model #.

2.15 VALVE BOXES

A. Required for each remote-control valve, quick coupler, ball valve, and stubbed ends of control wires per irrigation plans. The valve box shall be durable concrete with locking cast iron hinged lid. Emboss 'RCV' with valve number for remote control valves, 'QCV' for quick couplers, 'BV' for ball valves, and PB' for pull boxes with 2" high letters on the outside of the lids.

2.16 SHUT-OFF VALVES (BALL VALVES)

A. ASTM F-1970, Thermoplastic body. PVC: D-2467, D-2464; CPVC: F-439, F-437. Fort port design same I.D.as Sch 80 pipe. True Union design install in PVC valve box.

2.17 SHUT-OFF VALVES (GATE VALVES & BALL VALVES)

A. Refer to Irrigation System Plans for location and type of shut off valve.

B. 1"- 3", Nibco T-585-70-66 or T-580-70-66 or equal (Lead Free) full port, FIPT x FIPT, forged brass, Chromed Plated Ball, Teflon Seat, Two Piece Body, Ball Valve, 600 PSI non-shock WOG, 150 PSI SWP.

C. Threaded Ends Comply with ANSI B2.1. Valves shall be installed with the handle on the side, parallel with the ground when in the open position.

D. The handle shall be perpendicular to the ground, pointing upward when in the closed position.

2.18 SWING JOINTS

A. Mainline Quick Coupler: Harco Ductile Iron “3 Way Swing Joint” (# 879-15-10) Swing Joint Assembly kit – parts and order of assembly:
   1. 1 ½” D.I “Knuckle” Joint Restraint
   2. 1 ½” x 1 ½” D.I. Gasket x Female Swivel Coupling
   3. 1 ½” x 1 ½” Gasket x Male Swivel EL
   4. 1 ½” D.I “Knuckle” Joint restraint
   5. 1 ½” SCH 40 Bevel x Bevel Nipple
   6. 1 ½” “Knuckle” Joint Restraint
   7. 1 ½” D.I. Gasket x Male Swivel EL
   8. 1 ½” x 1” Female Swivel x MIPT EL
   9. Quick Coupler
   10. 1” D.I. Anchor (Harco part # 82201)

B. Spray heads and Rotors - Swing joints shall consist of schedule 40 PVC street ells and schedule 80 nipples of proper length per sprinkler head for rotor heads and marlex for street ells and swing pipe. Lateral Line: “3-way Swing Joint” – parts, and order of assembly: Pressure rated up to 315 psi, NDS TSA-0500-TT or TSA-0750-TT or equal.
   1. Lateral line fitting with FIPT outlet
   2. Marlex Street ELL
   3. MTBE Schedule 80 Nipple
   4. Marlex Street ELL
   5. PVC SCH 40 Street ELL

2.19 SPRAY AND ROTOR HEADS

A. Pop-up Spray Type: Full or part circle pop-up spray type sprinkler body, stem, nozzle and screen constructed of heavy-duty plastic. The sprinkler shall have a soft wiper seal for cleaning debris from pop up stem as it retracts into case to prevent sprinkler from sticking up. The sprinkler shall have a matched precipitation rate plastic nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall have a strong stainless steel retract spring for positive pop down. Pop up height shall be as indicated on plans. The sprinkler head shall have a screen under the nozzle to protect it from clogging and for easy removal for cleaning and flushing system. The sprinkler head shall have a bottom inlet and may have a side inlet for ease of installation. Use only the bottom inlet for sprinkler heads equipped with anti-drain devices. As Manufactured by Rain Bird 1800-SAM-PRS series. 1806 for turf areas, 1812 for shrub areas. Van and MPR spray heads.

B. Pop-up Rotary Type: Rotary sprinkler of the gear driven type. Rainbird 5000 or 6500 rotors for medium to large turf areas. Nozzles shall be available for true matched precipitation rates:
   1. The sprinkler shall be available in adjustable arc configuration. The adjustable arc sprinkler shall be adjustable from 40 degrees to 360 degrees in 1-degree increments. Adjustments shall be made from the top of the riser assembly in either the up or down position.
   2. The pop-up sprinkler shall be of height as indicated on plans. Nozzle shall be integrally molded multiple orifice type that can be changed with tools included. Radius shall be adjustable by means of an exchangeable nozzle or a movable diffuser pin. Nozzle turret shall be molded with a service indentation to accept a tool for raising nozzle piston for service.
   3. The sprinkler shall have a 3/4- or 1-inch NPT inlet and shall be accessible by a threaded cap for easy service.

4. The body of the sprinkler shall be constructed of non-corrosive heavy-duty ABS. The sprinkler shall be equipped with a filter screen for debris stoppage. The sprinkler shall also be available in shrub model with the same nozzle package. The sprinkler shall carry a 2-year unconditional warranty.
5. All sprinkler heads with similar functions shall be of common manufacture and, with the exception of shrubbery heads, shall be marked with the manufacturer's name and identification in a position where they may be identified without being removed from the system.

C. Swing Joint Assemblies:
1. Swing joint assemblies for pop-up spray type heads consisting of 1/2” inlets shall use two heavy-duty Marlex street ells, as manufactured by Spears – Model M412-XXX or equal, with a single schedule 40 PVC threaded ell and one schedule 80 nipples, lengths as listed in detail.
2. Swing joint assembly’s pop-up rotary type sprinklers consisting of 3/4” and greater sprinkler inlets shall be pre-assembled, double O-ring, schedule 80 PVC. Swing joint as listed by KBI – Model TSA or equal.

2.20 BUBBLERS / DRIP ASSEMBLIES

A. Low Volume Emitters: Hunter Bubbler, Salco, or approved equal.
1. Internal Check Valve feature, model (PST-CV) includes positive internal spring to hold back 9.25’ of elevated water.
2. 1/2” FIPT (PST) or ¼” barbed base (PS)
3. PC Flow: 0.5, 1, 2, 4, 5 or 10 gph.
4. Pressure range: 5-65 psi.
5. Zone Filtration: 100 – 150 mesh.

B. IH Series Riser:
1. Pre-assembled with two 1/2” MIPT UVR male adapters.
2. Maximum Flow: 7 gpm.
3. Maximum Pressure: 60 psi.

C. Low Flow Kit (Netafim LVCZNV10075-LF, LVCZNV10075-HF, or LVCZ-150-NV)
1. Plastic valve.
2. Pressure regulator
3. Filter 155 mesh

2.21 MASTER VALVE NORMALLY OPEN

A. Refer to Irrigation Plan Legend for Model Number. Maximum working pressure:
1. Manual Electric -235 psi
2. Pressure Reducing Manual Electric- 140 psi

B. Body: Cast iron, epoxy coated

C. Valve diaphragm: Reinforced natural rubber.

D. Connections:
1. National pipe thread
2. Flanged, drilled to ANSI Specifications.

E. Standards: EEC approved (Class A)

2.22 FLOW SENSING WIRING:

A. The flow sensor wire shall be a two conductor of ICEA class B, 16 AWG 7 strand, conforming to ASTM B3 and B-8, aluminum shield with drain wire, and shall have a jacket of 0.50 sunlight and moisture resistant PVC as manufactured by Paige Electric, Inc. (product #P7162D).

B. Flow sensor wire may be extended to a maximum distance of 2,000 feet from the location of the assembly to which it is connected. Wire shall be installed in a 1 1/4" PVC Schedule 40 pipe.

C. All conductors shall be the same type and shall be of the sizes shown on the drawings as required for proper operation of the systems.

2.23 FLOW SENSOR

A. The Model FM flow meter shall use two #14 AWG; one red, and one black in 1-1/4” PVC conduit to connect to the irrigation controller. The maximum wire run between flow meter and controller shall be 2000 feet The flow meter shall send low voltage digital pulses back to the controller and therefore all electrical connections must be waterproof and shall resist any moisture entry.

B. It is intended that all wire runs between the controller and flow meter shall be direct pulls and shall have no splices. If wire splices are unavoidable, they shall be installed in a valve box with Spears DS-100 connectors with Spears sealant or 3M Scotchlok No. 3570 connector sealing pack used, with valve boxes properly labeled.

C. Each flow meter shall have the following characteristics: 1.Housing to be a bronze tee 2.Have a pulsing output that operates at 9VDC and a pulse rate that is proportionate to the GPM 3.Fully compatible with the internal interface at each field controller 4.Powered by the controller 5.Replaceable metering insert shall feature a six-bladed design with a proprietary, non-magnetic sensing mechanism 6.Supplied by the same manufacturer as the irrigation controller.

D. Several controllers, up to twelve shall be able to share one or multiple points of connection with multiple flow sensors when each controller has been specified with the –FL (FLOWSENSE™) option. This option shall allow several controllers to share the irrigation programs and flow information for:
   1. Monitoring of system flows.
   2. Shortening water windows by maximizing the number of valves on without exceeding system flow capacity.
   3. Turning OFF valves with excessive flow rates due to broken lateral lines.
   4. Tracking water usage and comparing to a water budget.
   5. Eliminating relays when sharing pumps and master valves.
   6. Working in the field without the need for a central computer.

E. The communication method between controllers specified with the –FL (FLOWSENSE™) option shall be either hardwire cable or spread spectrum radio. The hardwire cable shall be a 4-conductor communication cable known as Paige P-7171-D in conduit. The controllers shall be specified with the –M communication option. The radio link shall be spread spectrum and the controllers shall be specified with the –SR communication option when hardwire is not feasible or cost effective. This allows the user to link several controllers with unlicensed frequency hopping radios. A radio survey conducted by the manufacturer is required prior to installation to confirm proper communication.

F. The hardwire and radio link options for the FLOWSENSE™ option shall be mixed on a project to create the most efficient system possible.

G. A field controller shall be able to interface and read up to three flow meters varying in size when the controller is specified as a –F option.

2.24 SURGE PROTECTION

A. All surge protection, grounding and installation of equipment specified, shall be installed in strict compliance with the manufacturer's recommendations and in accordance with Local, State and Federal requirements.
   1. Primary Power Surge Protection:
      a. Furnish and install surge protection on the power circuit that will supply power to the Interface.

2.25 TRACER WIRE

A. Paige P9494-UL 14-AWG copper wire 24-AWG jacket.

2.26 FILTER FABRIC MIRAFI 140N OR EQUAL, OR AS NOTED ON PLANS AND DETAILS

2.27 BURIED PIPING WARNING/IDENTIFICATION TAPE AND LOCATOR TAPE

A. Plastic warning / identification tape shall be an inert plastic film specially formulated for underground use. The minimum thickness shall be 4 mils.

B. Locator tape shall be installed over non-metallic pipe, shall be similar to warning tape, and shall include a metallic substance that can be registered by a magnetic field location device. Minimum thickness for locator tape shall be 5 mils. Locator tape shall be supplied by T. Christy Enterprises, Inc. or an approved equal.
   1. See table below for tape widths:

PIPE SIZE	TAPE WIDTH
Over 12"	12"
8" Thru 12"	6"
4" Thru 6"	6"
1" Thru 3"	6"

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify site conditions prior to the start of the work.

B. Verify location of existing utilities prior to the start of the work.

C. Verify that required utilities are available, in proper location, and ready for use.

3.02 PREPARATION

A. Piping layout indicated is diagrammatic only. Route piping to avoid trees, plants, ground cover, and structures.

B. Layout and stake locations of system components.
   1. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.
   2. Layout each sprinkler head and make any minor adjustments required due to differences between actual site conditions and the Drawings. Minor adjustments shall be maintained within the original design intent. Protect in place all existing trees and shrubs.
   3. Layout each system using staking method as approved by Owner's Representative. Maintain and protect approved staking layout.

C. All work shall conform to Section 308 of the "GREEN BOOK Standard Specifications for Public Works Construction" and except as modified herein. No work of this Section other than sleeving under pavement shall commence prior to the completion and acceptance of all grading work specified in Earth Moving Section.

D. Prior to all work of this Section, carefully inspect existing site conditions and equipment. Verify available pressure at point of connection and location of water meter provided by the Water Department.

E. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the reference standards and the manufacturer's recommendations.

F. In the event of discrepancy, immediately notify the Landscape Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

G. Trenches and other excavations for irrigation pipe and appurtenances shall be excavated true to alignment and grade and shall be of ample size for the proper performance of installation work, review, testing and backfill.

H. Protect all existing utilities and repair any damage to existing utilities with matching new materials, at no increase in contract price.

I. Generally, piping under concrete shall be installed by jacking, boring or hydraulic driving. Where any cutting or breaking of pavement, track sections and / or concrete work is necessary, it shall be removed and replaced by the Contractor. Permission to cut or break pavement, track sections and/or concrete shall be obtained from the Owner. No hydraulic driving will be permitted under asphalt concrete paving or track sections.

J. Coordinate with planting operations, as twelve-inch (12") deep cross ripping is required prior to irrigation systems installation. (Cross ripping is part of the planting work).

K. Provide technical services of the equipment manufacturer and the contractor to operate and adjust equipment specified under this section during the commissioning phase activities, which include startup and functional performance testing, and documentation elements.

3.03 TRENCHING

A. Trenching and backfill in accordance with Part 3.05 and this section.
   1. Minimum trench width shall be six inches (6").
   2. Minimum trench depth below bottom of pipe shall be two inches (2").
   3. Minimum cover shall be based on finished grades, unless otherwise noted on Drawings.

B. Trench Size:
   1. Minimum Width:
      a. (3/4” through 2” pipe) six inches (6”)
      b. (2½” & 3” pipe) eight inches (8”)
      c. (4” & 6” pipe) sixteen inches (18”)

C. Main Line Pipe Cover:
   1. (¾” through 2”) eighteen inches (18’) from finish grade to top of pipe.
   2. (2 ½” & 3”) twenty-four inches (24”) from finish grade to top of pipe.
   3. (4” & 6”) thirty inches (30”) from finish grade to top of pipe.

D. Lateral Line Pipe Cover:
   1. 12” Minimum cover from finish grade to top of pipe for spray heads.
   2. 15” Minimum cover from finish grade to top of pipe for turf rotors.
   3. 18” Minimum cover from finish grade to top of pipe for artificial turf “gun” rotors.

E. Trench to accommodate grade changes and slope to drains.

F. Maintain trenches free of debris, material, or obstructions that may damage pipe.

G. Pipe and Wire Sleeves minimum cover shall be twenty-four inches (24").

3.04 INSTALLATION

A. All piping or equipment show diagrammatically on drawing outside of planting areas shall be installed inside planting areas whenever possible.

B. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions and as indicated.

C. Line Clearances: Provide not less than 4" clearance between each line and not less than 6" clearance between lines of other trades. Do not install parallel lines directly over any other line.

D. Set the top of remote control boxes 1” minimum below finish grade; Sprinkler heads - located approximately as indicated on Drawings.

E. Provide for thermal movement of components in system.

F. Use threaded nipples for risers to each outlet.

G. Provide 24-inch expansion coil at each valve to which controls are connected, and 20-inch expansion coil at changes in direction. Bury wire beside main line pipe (except where noted on plan). Use a continuous wire between controller and remote control valves. “Loop” common wire on systems which have looped main. Each controller shall be provided with separate ground wire. Mark valves with neoprene valve markers.

H. Unless otherwise indicated, locate quick coupling valves within 12" of hardscape.

I. Valve Boxes: Provide at all locations indicated. Fill area under minimum of 3 cubic feet of 1 to 4 Corona crushed rock before box is installed. Identification – number each remote control valve box in 2" high characters (letters and numbers).

J. Verify with the District Representative the exact future location of the irrigation controller.

K. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

3.05 TRENCHING AND BACKFILL

A. Trenching
   1. Minimum trench width shall be:
      a. ¾” – 2” pipe - six inches (6")
      b. 2 ½” – 3” pipe - eight inches (8”)
      c. 4” – 6” pipe - eighteen inches (18”)
   2. Minimum trench bedding below bottom of pipe shall be three inches (3").
   3. Minimum cover shall be based on finished grades, unless otherwise noted on Drawings.

B. Main Line Pipe Cover:
   1. (3/4” through 2”) eighteen inches (18’) from finish grade to top of pipe.
   2. (2 ½” & 3”) twenty four inches (24”) from finish grade to top of pipe.
   3. (4” & 6”) thirty inches (30”) from finish grade to top of pipe.
   4. Pipe and Wire Sleeves minimum cover below traffic areas shall be twenty-four inches (24").

C. Lateral Line Pipe Cover:
   1. 12” Minimum cover from finish grade to top of pipe for spray heads.
   2. 15” Minimum cover from finish grade to top of pipe for turf rotors.
   3. 18” Minimum cover from finish grade to top of pipe for artificial turf “gun” rotors.
   4. Pipe and Wire Sleeves minimum cover below traffic areas shall be twenty-four inches (24").

D. Backfill

1. All plastic pipe in landscape areas shall be bedded and encased with approved, clean, fine, granular backfill material free of rocks and clods as indicated in the following table and /or shown on the plans. Plastic pipe in vehicular traffic areas (driveways, parking lots etc.) shall be bedded and encased with plaster sand. Protruding rocks from the trench bottom shall be removed.
2. The balance of backfill material from the top of the protective layer above the pipe to grade shall be:
   a. Thickness Under Thickness Above Thickness at Side
   b. Pipe Minimum Pipe Minimum of Pipe Minimum
   c. Three inches (3") Six inches (6") Three inches (3")
3. Provide not less than four inches (4") clearance between each line and not less than six inches (6") clearance between pipe/conduit of other trades, unless otherwise noted.
4. Do not install parallel lines directly over any other line.
5. The balance of backfill material from the top of the protective layer above the pipe to grade shall be approved material with particles no larger than three quarters of one inch (3/4”) in size. Unsuitable material, including clods and rocks over three quarters of one inch (3/4") in size, shall be removed from the premises and disposed of legally at no cost to the Owner.
6. Backfill material shall be sufficiently compacted under and on each side of the pipe to provide support free of voids. Pipe joints shall remain exposed until the completion of pressure and leakage test, unless authorized by the District Representative (Grounds Supervisor). The remainder of the backfill material shall contain no lumps or rocks larger than three quarters of one inch (3/4”) nor contain rubbish and debris.
7. Backfill shall be tamped to the dry density of adjacent soil. Backfill with areas of structurally compacted soils shall be returned to the original relative density as before trenching.

3.06 INSTALLATION OF PIPE

A. Unless otherwise specified, the construction of lateral lines and main lines shall include excavation and backfill, the furnishing, installing and testing of pipe, tube, and fittings, the furnishing and installing of anchors, thrust blocks, and wire, the improvements, line flushing and testing, and all work in accordance with the plans and specifications.

B. Polyvinyl chloride pipe shall be installed in such a manner so as to provide for expansion and contraction as recommended by the manufacturer.

C. All polyvinyl chloride pipe, shall lay free in the trench with no induced strain. Where there is evidence of induced pipe strain, the Contractor shall be required to make pipe cuts and install angle fittings as necessary to eliminate the strain.

D. When a connection is plastic to metal, a Schedule 80 (machine cut threads) TOE (thread one end) nipple shall be used. The nipple shall be hand tightened, one to two turns beyond finger tight with a strap wrench. Joint compound shall be IPS weld-on Teflon pipe joint compound or approved equal. (No female PVC threaded fittings on the main line.)

E. The Contractor will be required to remove and replace any fitting which induces a torque strain to the pipe.

F. Polyvinyl chloride pipe shall be cut with PVC pipe cutter, hand saw or hack saw with the assistance of a miter box or in a manner so as to ensure square ends. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained. I.P.S. weld on, deburring tool # DEB-2 is recommended for fast pipe deburring.

G. All plastic-to-plastic joints shall be solvent-weld joints. Only the IPS WELD-ON solvent & primer shall be used.

H. The solvent-weld joints shall be made in the following manner:

1. Thoroughly clean the mating pipe and fitting with a clean dry cloth.
2. Try the parts for fit. The parts should "dry-mate" between one-third (1/3) and two-third (2/3) the depth of the socket. If adequate insertion is not obtained, or bottoming occurs, try another part until a satisfactory "dry-fit" is obtained.
3. The glue should be fresh and drip freely from the applicator.
4. First apply primer to the pipe end and fitting socket to make joining surfaces soft and semi-fluid.
5. After primer, cement must be applied to fill the gap between pipe and fitting.
6. Assembly of pipe and fittings must be made while the surfaces are still wet and fluid. (Note: it may be necessary to “double coat” male end of pipe with light coat of cement, when working in hot weather with larger diameter pipe, before inserting pipe end into fitting socket.)
7. Give the pipe or fitting a quarter turn to ensure even distribution of the solvents and make sure that the pipe is inserted to the full depth of the fitting socket.
8. Hold in position for at least thirty (30) seconds.
9. Wipe off excess solvent that appears at the outer shoulder of the fitting.
10. Note: All solvent-weld operations should be executed without delay between each procedure. The primer should be “wet” on the pipe when the glue is applied. Tape the primer can to the glue can for fast and accurate work.

I. Pressure supply steel pipe and fittings: Apply Permatex 51 D to male and female threads.

J. Assemble Gasketed PVC pipe in the following manner:
1. Clean the gasket area. Remove sand, dirt, grease, and debris. Do not remove the gasket from the bells – removal could cause improper reinstallation.
2. Check the gasket. Make sure the gasket is seated uniformly in the groove by running your finger around the inner edge of the gasket.
3. Clean the spigot. Use rag to wipe the spigot clean.
4. Lower the pipe into the trench. Lower carefully to avoid getting dirt into the bell or spigot.
5. Lubricate. Apply lubricant to the bevel end of the spigot, approximately mid-way to the stop line. A thin layer of lubricant must be applied to the face of the gasket; but, be careful not to get lubricant behind or under the gasket. WARNING: use only lubricants approved by the pipe manufacturer. The use of lubricants not approved by the manufacturer may cause deterioration of pipe or gasket.
6. Keep lubricated areas clean. If dirt or sand adhere to the lubricated areas, clean and re-lubricate.
7. Assemble pipe. Insert the spigot end into the pipe until it contacts the gasket uniformly. Straight alignment is essential for ease of assembly. Apply steady pressure by hand or by mechanical means (bar & block, come-along, hydraulic jack) until the spigot slips through the gasket. Insert pipe until the stop line is flush with the bell end. WARNING: Do not use a backhoe, trencher or tractor for assembly – the action of this kind of power equipment can damage bells or dislodge gaskets from raceways.
8. If undue resistance to pipe insertion is encountered or if the pipe cannot be inserted to the reference mark, dissemble the joint and check the position of the gasket.
    a. If the gasket has been dislodged from the race, inspect the pipe and gasket for damage, replace damaged items, clean the components, and repeat the assembly steps, assuring straight alignment.
9. Cut the pipe square. The pipe can be cut with a handsaw or power saw. To insure a square cut, use a miter box. Bevel the end of the pipe with a plastic pipe beveller tool to form a three quarter inch long 15 degree factory bevel.

K. Thrust Block for mainline gasketed directional fittings.
1. Size as per drawing.

L. Thrust Block for Air and Vacuum Relief Valve.

1. Size as per drawing.

M. Provide concrete thrust blocks at each change of direction and at all terminal points of all rubber gasket piping. Block in accord with pipe manufacturer's instructions.

N. Provide thrust blocks at all changes of directions and reductions shall be mechanically retrained. Additional thrust blocks shall also be restrained as per manufacturer’s recommendations.

O. Joint Restraints.
   1. All joint restraints shall be installed in complete accord with Harco Manufacturing Company’s instructions.
   2. The linear distance of restrained gasketed pipe on the plan supersedes the joint restraint charts in the Specification Addendum.

3.07 INSTALLATION OF PIPE UNDER NEW PAVED AREAS

A. Coordinate installation of piping and wires under paved areas with other trades.

B. All pipes under pavement surface to be installed a minimum of 24 inches below A.C. paving with a 6-inch bedding and a 6-inch cover of sand backfills.

C. If the only piping installed is over 20 feet long, pressure testing is required for that section at the time of installation. Upon completion of piping installation, the entire system must be tested.

D. If wire under paved areas cannot be continuous, all splices shall be enclosed in an approved pull box.

3.08 INSTALLATION OF PIPE UNDER EXISTING PAVING

A. Piping under existing pavements may be installed by jacking, boring or by hydraulic driving, except as otherwise specified or directed. When placing piping for sleeves use SDR 35 PVC pipe.

B. All pipes under pavement surface to be installed a minimum 24 inches below A.C.

C. Secure Owner's permission prior to cutting or breaking existing pavements.

D. Make completely clean cuts using power saws at approved locations only.

E. Replace and restore all surfaces to original condition, including grade, landscaping, track surfacing and A. C. paving.
   1. Restoration work shall match the original work in every respect, including type, strength, texture and finish.
   2. Consult with Owner for approved methods of patching and /or replacing any damaged track sections as a result form boring, saw cutting or removal.

3.09 INSTALLATION OF CONTROL WIRE

A. Refer to demolition plan for note and reference to existing wire location.

B. Unless otherwise specified, the installation of control wire shall include excavation and backfill, the furnishing, installing and testing of the wires, the removal and / or restoration of existing improvements and all other work in accordance with the plans and specifications.

C. Unless otherwise specified all neutral (common ground) wire shall be AWG #12 and all pilot (valve control) wire shall be AWG #14. Paige wire is the approved District Standard.

D. Limit splicing of electrical wiring. Provide each splice made at intervals or in electric control valve assembly valve boxes with approved connectors. Use wire connector as manufactured by 3m model DBR/Y-6 Direct Bury pre-filled Waterproof connector.

E. Install schedule 40 electrical conduit with the wire pulled through it in the same trench and along the same routing as the pressure supply lines unless otherwise approved.

1. Install wiring prior to main line whenever possible.

F. Provide a 36” expansion loop at each connection. Use a continuous wire between controller and remote-control valves.
   1. Except as otherwise approved, do not splice wire at any point.
   2. All approved splices shall be enclosed in an acceptable box. All wire splicing shall take place in the valve boxes and / or pull boxes. All splices shall be made with a mechanical connector encased in a self-curing epoxy resin which provides a permanent watertight connection.
   3. All wire to be pulled in not less than schedule 40 electrical conduit (grey) and appropriate electrical conduits fittings (long sweeps).

G. If joint trench with water, a pipe tree will be used to keep pipe two inches apart.

H. Unless otherwise specified, the installation of control wire shall include excavation and backfill, the furnishing, installing and testing of the wires, the removal and / or restoration of existing improvements and all other work in accordance with the plans and specifications.

I. At least one spare wire shall be installed from the controller clock to the most distant valve. When wire runs go in different directions from the controller clock, a separate spare wire shall be installed from the controller clock to the most distant valve in each different wire run direction.

J. Tape and bundle all control wires at ten feet (10') o.c. maximum; place wiring with eighteen inch (18") minimum cover. When wiring is placed in common trenches with piping, set wiring two inches (2") from any piping. Place control wire alongside of pipe. Do not place over the pipe.

K. All wire splicing shall take place in the valve boxes and/or pull boxes. All splices shall be made with a mechanical connector encased in a self-curing epoxy resin that provides a permanent watertight connection. No underground splices will be allowed.

L. All direct burial control wires shall be identified as to their respective valve number and controller clock letter in all pull boxes and at all wire termination. Spare wires and "future valve" wires, if any, shall also be identified. Labels and tags shall be used for identification which are not affected by moisture or temperatures between minus 30 degrees Fahrenheit. and plus 200 degrees Fahrenheit. The labels and tags shall be resistant to abrasion, dirt, grease, and chemicals used in lawn fertilizers and conditioners. The labels and tags shall be firmly attached to the wire in every case. The Contractor shall submit samples of the labels or tags to be used to the Architect for recommended approval, prior to the installation of the control wire. Examples of nomenclature of tags or labels are as follows:

Neutral (common ground) wire	= "Neutral" Clock "A"
Pilot (valve control) wire	= "A.V. #1." Clock "A"
Spare Wire	= "Spare" Clock "A"

M. The final operating sequence of the remote-control valves, within each individual controller clock, shall be as called out on drawings.

N. Testing:
   1. All direct burial control wire installed shall be tested in the following manner.
      a. Before any backfill material is placed over the control wires in the trench, the wires shall be tested with a meter for insulation resistance. Minimum insulation resistance to ground shall be fifty (50) megohms. Any conductor not meeting this requirement shall be replaced.
      b. After backfill encasement, the wires shall again be tested with a meter. The minimum acceptable insulation resistance to ground on this test shall be one (1) megohm. Any conductor not meeting this requirement shall be replaced.

3.10 INSTALLATION OF VALVES

A. General: Unless otherwise specified, the installation of the valves shall include excavation and backfill, the furnishing, installing and testing of fittings and valves, the furnishing and installing of valve boxes appurtenances, accessories, the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications.
   1. Fill area under valve box with a minimum of three (3) cubic feet 1 to 4 Corona crushed rock before box is installed.

B. Shut-off Ball Valves: Shut-off valves installed underground shall be housed in a suitable valve box, consisting of a concrete valve box and a concrete lid.

C. Quick Coupling Valves: Unless otherwise indicated, locate valves within twelve inches (12") of hardscape. Install in designated valve box.

D. Automatic Control Valves: Automatic control valves shall be set upright and housed in designated valve box, with a concrete top. The Contractor shall place Christy's Standard Valve Identification tags on each valve corresponding to its appropriate valve station number.

3.11 INSTALLATION OF AUTOMATIC CONTROLS

A. Unless otherwise specified, the installation of automatic controllers shall include the test of controllers and connection, and all other work as called for on the plans and/or in the specifications.

3.12 INSTALLATION OF SPRINKLER HEADS

A. Unless otherwise specified, the installation of sprinkler heads shall include excavation and backfill, the furnishing, installing and testing of risers, fittings and heads. The removal and/or restoration of existing improvements and all other work shall be in accordance with the plans and specifications.

B. Flushing: All water lines shall be thoroughly flushed out before heads are installed.

C. Location and arc of heads shall be adjusted, if required to eliminate any dry spots, over water or spillage on adjacent areas.

D. Location of drip emitters are to be placed 2" below grade, on the high side of the rootball, allowing gravity to direct the water flow into the root ball, when one emitter is specified. When two or more emitters are specified, locate evenly spaced around the rootball eliminating any dry spots.

E. All lawn sprinkler heads to be installed adjacent to existing walks, curbs, or other paved areas, shall be set to the grade of the existing improvements. Sprinkler heads, which are to be installed in areas where the turf has not yet been established, shall be set two inches (2") above the proposed finished grade. The Contractor prior to final acceptance shall lower heads installed in this manner. In established lawn areas the sprinkler heads shall be set to existing grade.

3.13 SWING JOINTS

A. Swing-joints will consist of three street elbows plus one Schedule 80 riser of proper length per sprinkler head.

B. Marlex may be used with Teflon Tape at all turf / shrub body assemblies.

3.14 FIELD QUALITY CONTROL

A. Field inspection will be performed by the District and system Designer.

B. Inspections by District Representative:

1. Material inspection: Inspection at the job site of all materials to be used on the job. The contractor shall store the materials at the job site in a locked container. Note: no work shall start until all the materials to be used on the job are approved by the district representative. NOTE: The District shall not be responsible for the theft or damage of any tools or materials left on site.
2. Irrigation main line and drinking fountain line open trench inspection. Note: the contractor at his discretion may partially back fill the trenches before inspection. All pipe joints must be exposed for inspection.
3. Irrigation main line open trench equipment inspection: remote control valves, quick couplers, air valves etc.
4. Lateral line open trench inspection. Note: the contractor, at his discretion, may partially backfill the trenches before inspection and approval. The pipe joints, swing joints, spray and rotor heads must be exposed for inspection.
5. Coverage test.
6. Final inspection and approval.
7. After each inspection, no work shall start on the next phase until the work to date has been approved in writing and all corrections are completed by the contractor.

C. Pressure Test: Prior to complete backfilling, test all pressure lines for leakage.
1. Test all pressure lines under hydrostatic pressure of 150 pounds per square inch or 50 pounds more than normal static pressure (whichever is greater), and prove watertight for (3) Three hours.
   a. Note: If any of the threaded metal pipe joints assembled with Permatex 51 D pipe joint compound are leaking and causing the system to fail the pressure test, re-test the system for twenty-four hours under the required test pressure before disassembling the leaking fittings. Permatex 51 D has self-sealing properties under pressure and time.
2. The District Representative may require (at his/her discretion) the pressure testing of the main line prior to installation of electric control valves, quick couplers, saddles or any other equipment that might prevent a proper test from being performed.
3. Test all piping under paved areas under hydrostatic pressure of 150 pounds per square inch for two hours, and prove watertight prior to paving.
4. Sustain pressure in lines for no less than 3 hours. If leaks develop (more than 5 percent), replace joints and repeat test until entire system is proved watertight.
5. All hydrostatic tests shall be conducted only in the presence of the District Representative. Do not completely backfill pipe until it has been inspected, tested and approved in writing.
6. Furnish necessary force pump and all other test equipment.
7. When the sprinkler irrigation system is completed, perform a coverage test in the presence of the District Representative to confirm that water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate without notifying the District Representative. This test shall be accomplished before any planting occurs.
8. Provide handheld walkie-talkie or personnel as necessary to accomplish this task expeditiously.
9. Upon completion of each phase of work, test and adjust entire system to meet site requirements.
10. Test any low voltage wiring more than 50 feet long installed under paving for continuity prior to paving.

D. System is acceptable if no leakage or loss of pressure occurs during test period.

3.15 BACKFILLING

A. Backfill in accordance with Part 3.03, Part 3.05 and this section.

B. In landscaped areas Provide six inches (6”) of clean, fine, granular soil on top of the pipe in the and three inches (3”) of clean, fine, granular soil under the pipe. In vehicular traffic areas (driveways, parking lots etc.) provide six inches (6”) of plaster sand on top of the pipe and three inches (3”) of plaster sand under the pipe.
   1. Backfill from the top of the protective layer to finish grade shall have no particle larger than three quarters of an inch (3/4”). Backfill trench and compact to sub grade elevation as specified above. Protect piping from displacement with a minimum of 85% compaction in landscape areas and 90% compaction in hardscape (paved) areas.

C. After the initial excavation for the mainline trench, if it is found that the soil has too many rocks, making it impractical to remove the rocks from the spoils, notify the District Representative immediately.
   1. After all the spoils are removed from the site, the entire main line in the landscaped areas, shall be covered with imported clean fine, granular soil (approved by the District Representative) from the bottom of the trench to the top of finish grade, at no additional cost to the District.
   2. In vehicular traffic areas, install approved imported soil from the protective sand layer to the top of finish grade.
   3. The excess spoils shall be exported from the job site at no additional cost to the District. The allowance referred to in the Supplementary General Conditions shall be used for this work in the event it is needed. If the excavation allowance is not utilized, a credit shall be taken at the conclusion of the project.

3.16 INSTALLER'S FIELD SERVICES

A. Prepare and start systems per manufacturer’s guidelines.

B. The entire sprinkler irrigation system shall be operated automatically for a period of seven days prior to any planting.

C. The District Representative reserves the right to waive or shorten the operation period.

D. After the maintenance period, demonstrate in presence of the District Representative that the system is in proper operating order.

3.17 ADJUSTING

A. Adjust work as directed by the District.

B. Adjust control system to achieve time cycles required.

C. Adjust head types for full water coverage as directed.

3.18 DEMONSTRATION

A. Adjust work as directed by the District.

B. Instruct Owner's personnel in operation and maintenance of system, including adjusting of sprinkler heads and recommended winterization procedures. Provide this training at the District’s convenience. Use operation and maintenance manual as basis for demonstration.

3.19 CLEANUP

A. Perform cleanup as each portion of the work progresses. Remove refuse and excess dirt from the site, and sweep or wash down all walks, paving and vegetation. Repair any damage to the work of others and return to the original condition.

3.20 INSPECTIONS

A. The contractor shall give forty-eight hours' notice to the district representative when each phase of the job will be ready for inspection.

B. Main Line open trench inspection: One inch (1") through four inch (4"), the contractor may partially backfill the trenches before inspection. All saddles, pipe joints, quick couplers, air valve, ball valves, and remote control valves must be exposed for inspection.

C. Drinking Fountain Line open trench inspection. The contractor may partially backfill the trenches before inspection. All pipe joints and the pressure regulator must be exposed for inspection.

D. Main Line pressure test the main line for two hours' minimum with the aid of a force pump to a pressure of fifty pounds per square inch over the static pressure or 150 pounds, whichever is greater. Note: thrust blocks or joint restraints (as specified) must be installed on the gasketed main line and the pipe "center loaded" between exposed pipe joints with approved back fill to prevent pipe from shifting.

E. Drinking Fountain Line pressure test. Pressure test drinking fountain line for two hours' minimum with the aid of a force pump to a pressure of fifty pounds per square inch over the static pressure or 150 pounds, whichever is greater.

F. Lateral Line open trench inspection. The contractor may partially backfill the trenches before inspection. All pipe joints, swing joints, and rotor heads, must be exposed for inspection.

G. Drinking Fountain drainage system open trench inspection. The contractor may partially backfill the trenches before inspection. All pipe joints and seepage tanks must be exposed for inspection.

H. Coverage test. Coverage test of all rotor heads in the presence of the district representative.

I. Final inspection. Check all subsystems to verify that they are in good working order.
   1. SPECFICATION ADDENDUM JOINT RESTRAINT CHARTS
   2. Note: This section contains computer generated joint restraint charts for when a job specifying joint restraints with Gasketed pipe is a component of the project.

3.21 THRUST BLOCKS

A. Thrust blocks shall be concrete 2000 psi at 28 days. They shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set.

3.22 INSTALLATION OF WARNING TAPE

A. Warning tapes shall be installed directly on top of the pipe longitudinally and shall be centered. The warning tape shall be installed continuous for the entire length of the pipe and shall be fastened to each pipe length by plastic tape banded around the pipe with fasteners no more than 5 feet apart. Taping attached to the sections of pipe before laying in the trench shall have flaps sufficient for continuous coverage. All risers between the mainline and control valves shall be installed with warning tape.

3.23 RECORD DRAWINGS

A. The Contractor shall provide and keep up to date on a daily basis, a complete record set of bond copies in black and white which shall be corrected daily and show every change from the original Drawings and specifications and the exact locations, sizes and kinds of equipment in red ink. Prints for this purpose may be obtained from the Owner. This set of Drawings shall be kept on the site and shall be used only as a record set. Architect shall review drawings prior to any planting.

B. In order to complete the record Drawings in a neat, legible manner, the contractor shall indicate the necessary changes on Mylar tracings procured from the Owner / Landscape Architect.

C. The contractor shall dimension from two (2) permanent points of reference, building corners, sidewalks, etc., the location of the following items if applicable:
   1. Point of connection and / or water meter (referenced from known existing elements to remain).
   2. Pump stations.
   3. Connection to existing water lines.
   4. Connection to electrical power.
   5. Routing of pressure supply lines at every 100 feet along routing.
   6. Backflow prevention devices.
   7. Pressure regulators.
   8. Flow sensors.
   9. Master valves.
   10. Fertilizer injectors.
   11. The routing of the sprinkler main lines (Dimension every, one hundred feet 100' maximum and at change in direction).
   12. Routing of control wiring by valve number and location of existing controller.
   13. Gate valves.
   14. Ball valves.
   15. Control valves.
   16. Isolation gate valves.
   17. Isolation ball valves.
   18. Quick coupling devices.
   19. Air release valves.
   20. Electric control valves.
   21. Check valves.
   22. Field satellite units / controllers.
   23. Grounding rods.
   24. Show where sleeves are installed under paving and concrete.
   25. Any other pertinent underground item, if so deemed by the Landscape Architect.
   26. Control wire routing (if routed separately from pressure supply line).
   27. Communication cable routing (if routed separately from pressure supply line).
   28. Communication cable and control wire splices that are outside of control unit or field satellite unit.
   29. Other equipment as directed by District.

D. Prior to scheduling a walk through for Substantial Completion, provide a record set of field drawings as described above to the district for review. After review, the district will return the set to the field foreman requesting further information or will notify that the record set of field drawings are complete. After approval from the district, a walk through for Substantial Completion may be scheduled.

E. Prior to scheduling the final walk through, the final set of irrigation record drawings shall be professionally drafted.

F. Contractor is responsible for delivering the final set of record drawings to the district prior to initiating the maintenance period.

3.24 CONTROLLER CHARTS

A. Do not prepare charts until record Drawings have been approved by the Owner’s representative.

B. Provide in controller chart for each automatic controller installed.

1. Chart may be a reproduction of the record drawing if the scale permits fitting the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
2. Chart shall be black line print of the actual system, showing the area covered by that controller.

C. Identify the area of coverage of each remote-control valve, using a distinctly different pastel color, drawn over the entire area of coverage.

D. Following approval of charts by Owner's representative, they shall be hermetically sealed between two layers of 20-mil thick plastic sheet.

E. Charts must be completed and approved prior to final review of irrigation system.

3.25 TESTS

A. Pressure Tests:
1. All pressure lines shall be tested under hydrostatic pressure of 150 pounds per square inch, and all non-pressure lines shall be tested under the existing static pressure, and both be proved watertight. Contractor shall provide all equipment for hydrostatic tests at no cost to the Owner.
2. Pressure shall be sustained in the lines for not less than two (2) hours. If leaks develop, the joints shall be replaced, and the test repeated until the entire system is proved watertight.
3. Tests shall be observed and recommended for approval by the Landscape Architect / and or owners field superintendent prior to backfill.

B. Coverage Test:
1. When the irrigation cooling system is completed, the Contractor, in the presence of the Landscape Architect, shall perform test coverage of water afforded the field areas, complete and adequate. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage disclosed arising from his work.
2. Contractor shall inform the Owner's representative of any deviation from the plan required due to wind, planting, soil or site conditions that bear on proper coverage; and upon approval, perform changes to provide for proper coverage at no additional cost to Owner.

3.26 REVIEWS

A. Normal Progress Reviews: Normal progress reviews shall be requested from the Architect at least forty-eight (48) hours in advance of any anticipated review. A review will be made by the Landscape Architect on each of the steps listed below. The Contractor will not be permitted to initiate the succeeding steps of work until he has received written approval to proceed by the inspector.
1. Immediately prior to the commencement of the work of the Section.
2. Pressure supply line installation, trenching and testing.
3. System layout.
4. After placement of all heads, valves and controllers for coverage test.
5. Final review and receipt of "Record Drawings" and "Controller Charts."
6. Final acceptance of project by Owner.

B. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval. The Contractor, at his expense, shall open any work covered prior to review to view.

C. Unprepared Review Requests: In the event the Contractor requests review of work and said work is incomplete, the Contractor shall be responsible for review cost.

D. Completion: The work will be accepted, in writing, when the whole shall have been completed satisfactorily to the Owner. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved by the Owner, in writing, at the proper times.
   1. Leave the entire installation in complete operating order, free from any and all defects in material, workmanship or finish, regardless of any discrepancies and / or omissions in plans or specifications.
   2. Remove from the site all debris and rubbish resulting from the work and leave the installation in clean condition.

3.27 GUARANTEE

A. The installed irrigation system shall be guaranteed by the Contractor as to material and workmanship, including settling of backfilled areas below grade for a period of one (1) year following the date of final acceptance of the work.

B. The Contractor, as part of the work under his contract, shall make all adjustments without extra cost to the Owner, including the complete restoration of all damaged planting, paving, or other improvements of any kind.

C. Should any operational difficulties in connection with the sprinkler system develop within the specified guarantee period which in the opinion of the Owner may be due to inferior material and / or workmanship, said difficulties shall be immediately corrected by the Contractor to the satisfaction of the Owner at no additional cost to the Owner, including any and all other damage caused by such defects.

D. The Owner reserves the right to make temporary repairs during the guarantee period as necessary to keep systems in operating condition without voiding the Contractor's guarantee, nor relieving the Contractor of his responsibilities.

3.28 TURN OVER ITEMS

A. Turn over items shall include quick coupler keys, and as built prints.

B. Refer to equipment to be furnished under specification Section 1.11 for list of additional items.

3.29 MAINTENANCE

A. Maintenance of irrigation system prior to job completion, and during the Landscape Maintenance period, shall be the responsibility of the Contractor including, but not limited to, the following:
   1. Cleaning of plugged irrigation heads.
   2. Irrigation heads adjustments.
   3. Volume of water being applied. (Coordinate with landscape maintenance).
   4. Programming of the controller. (Coordinate with landscape maintenance).
   5. Repairing leaking valves, etc.
   6. Any other problem areas, which occur after installation, attributed to the irrigation system.
   7. Repair or replace equipment due to acts of vandalism, theft or pest damage.
   8. Lower all turf heads to final grades prior to final acceptance by Owner.

B. The contractor’ responsibility for the irrigation of plant materials and the maintenance and repair of the irrigation system begins on the contract start date. The methods that are required to irrigate the grounds include automatic irrigation systems and hand or portable irrigation components. The contractor shall plan and adjust irrigation schedules for automatic, hand or portable irrigation system.

C. Sprinkler Heads: Irrigation includes watering of lawns, shrubs, trees, palms, ground cover and plants. Care shall be exercised by regulating the time and equipment to prevent wasting of water. Watering shall be done in a manner that will avoid erosion, run-off, or ponding due to excessive quantities or rate of application. Sprinkler heads shall be adjusted to prevent water spray on buildings and sidewalks. It shall be the contractor's responsibility to apply enough water to assure and maintain the health and vigor of all lawn, shrubs, trees, and planted areas.

D. Water Restrictions: The contractor shall be in compliance with Federal, State and local water agencies and authorities' directives. The district reserves the right to reduce or eliminate watering during water shortages. The contractor shall be held liable for fines imposed by Federal, State and/or local water agencies.

E. The contractor is responsible for required irrigation by any means during the periods of system breakdown.

F. Frequency of Services: Irrigation Maintenance shall be weekly. Automatic watering systems in the immediate area of pedestrian traffic shall be set to operate during the hours of 10:00 PM to 4:30 AM.

REV NO.	ISSUE	DATE

END OF SECTION

SECTION 329119
LANDSCAPE GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Weeding.
B. Finish grading for lawns
C. Finish grading for planting areas.

1.02 RELATED REQUIREMENTS

A. Division 31 Section Site Clearing
B. Division 31 Section Grading
C. Division 32 Section Decomposed Granite Surfacing
D. Division 32 Section: Landscape Work

1.03 DEFINITIONS

A. Finish Grading: finish grading shall consist of adjusting and finishing soil surfaces with site or imported topsoil, raking grades to a smooth, even, uniform plane. Remove and legally dispose of all extraneous matter off site. Facilitate natural run-off water and establish grades and drainage indicated as part of the contract work.
B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 3/4-inches (19 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
C. Finish Grading: Finish grading shall consist of finishing surfaces by raking smoothly and evenly to facilitate natural run-off water, and by removing and disposing of extraneous matter.
D. Sub-grade: The surfaces upon which additional specified materials are to be placed, prepared, or constructed.
E. Rough Grade: The establishment of grades to required tolerances.
F. Finish Grade: Spot elevations (grades) are indicated based on the best available data. Contract Civil Drawings are referenced to provide additional site grading information. It is intended that constant slopes are maintained between spot elevations.
G. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.04 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.05 EXISTING UTILITIES

A. Stake and mark the location of existing utilities before commencing work.

B. Retain and protect in operating condition all active utilities traversing the site designated to remain.

1.06 QUALITY ASSURANCE

A. Finish grade shall conform to contours, grades, lines, and shapes, as indicated on Contract Drawings, with uniform slopes between finish grades or between finish grades and existing grades.

B. Establish finish landscape grades in a continuous, uniform line, resulting in a uniform surface with no ridges or water pockets.

C. Finish landscape grade tolerance shall be 0.04-feet plus-or-minus from finish elevations indicated on site drawings.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS:

A. Topsoil: A natural, fertile, friable soil, free from stones, roots, clods larger than 1" in diameter, noxious seeds, weeds, subsoil, undesirable insects, plant disease or any other natural objects detrimental to normal plant growth.
   1. Silt plus clay content of the import soil shall not exceed 20% by weight with a minimum 95% passing 2.0-millimeter sieve.
   2. Total pore space content on a volume/volume basis shall be at least 15 percent at field capacity.
   3. Permeability rate shall be not less than one inch per hour or more than 20 inches per hour.
   4. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECE) shall not exceed 2.0 milliohms per centimeter at 25 degrees centigrade.
   5. Soluble boron shall be no greater than 1.0 part per million (mg/l).
   6. Soil pH range shall be 6.0 - 7.9.
   7. Maximum concentration of soluble chloride shall be 150 parts per million.
   8. Maximum concentration of heavy metals shall not exceed the following when the pH is between 6 and 7:
      a. Arsenic: 1 ppm
      b. Cadmium: 1 ppm
      c. Chromium: 5 ppm
      d. Cobalt: 1 ppm
      e. Lead: 15 ppm
      f. Mercury: 0.5 ppm
      g. Nickel: 2.5 ppm
      h. Selenium: 1.5 ppm
      i. Silver: 0.25 ppm
      j. Vanadium: 1.5 ppm
   9. Petroleum hydrocarbons shall not exceed 100 mg/kg dry soil.
   10. Aromatic volatile organic hydrocarbons shall not exceed 2 mg/kg dry soil.

B. Obtain imported topsoil from approved local sources.

C. All topsoil to be used for planting, regardless of whether import or on-site in origin, shall be tested as described in Part 3 of Section 329300.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verification of conditions: Prior to commencing the finish grading, review the installed work of other trades and verify that their work is complete.
   1. Rough Grading: Grading in planting areas (except raised planter areas) shall be established to within plus or minus 0.10 foot prior to beginning of finish grading.

B. Import topsoil only when necessary to supplement site soil to achieve grades shown on Drawings, or if site soil is unsuitable for planting.

3.02 PREPARATION:

A. Weeding: Before finish grading, weeds and grasses shall be dug out by the root or sprayed with an herbicide and disposed of off-site. This procedure is outlined in Section 329300-Landscape Work.

B. Remove debris, roots, branches, weeds, stones, in excess of 1/2-inch (13 mm) in size and clumps of earth that do not break up. Before and during finish grading, remove weeds and grasses, including roots, and dispose off-site.

C. Remove soil contaminated with petroleum products and legally dispose off-site.

3.03 INSTALLATION:

A. General: When rough grading and weeding have been completed, and the soil has dried sufficiently to be readily worked, lawn and planting areas shall be graded to the elevations indicated on the Drawings.
   1. Grades indicated on Drawing are grades that will result after thorough settlement and compaction of the soil.
   2. Grades not otherwise indicated shall be uniform finish grades and, if required, shall be made at the direction of the Architect.
   3. Finish grades shall be smooth, even, and a uniform plane with no abrupt change of surfaces.
   4. Soil areas adjacent to buildings shall slope away from the building to allow a natural run-off of water, and surface drainage shall be directed as indicated on the drawings by remodeling surfaces to facilitate the runoff water at 2% minimum grade.
   5. Low spots and pockets shall be graded to drain properly.

B. Drainage: Finish grade with proper slope to drains.
   1. Flow lines, designated or not, shall be graded and maintained to allow free flow of surface water.
   2. If any drainage problems arise during construction period due to Contractor's work (such as, but not limited to, low spots, slides, gullies and general erosion), the Contractor shall be responsible for repairing these areas to a condition equal to their original condition, and in so doing shall prevent further drainage problems from occurring.

C. Prior to placing backfill, remove rock, aggregate base, concrete, and deleterious materials to a depth of 18 inches below soil grade in planter areas. Cross-rip subsoil of friable soil to a depth of 12-inches.
   1. Place a minimum of [15-inches] of topsoil backfill in planters.
   2. Refer to Section 329300 “Landscape Work” for soil materials.

D. Toe of slope: To prevent soil creep or erosion across pavement, where pavement (walk, curb, etc.) is at the toe of a slope, finish grade is to level out or swale slightly at least 12-inches before reaching pavement.

E. Moisture Content: The soil shall not be worked when the moisture content is so great that excessive compaction occurs, nor when it is so dry that dust may form in the air or that clods do not break readily. Water may be applied, if necessary, to provide moisture content for tilling and planting operations. It is the Contractor’s responsibility to control dust that is spread as a result of grading operations.

F. Grades: The finish grade in areas to be planted with turf shall be 1-inch below grade of adjacent pavement, walks, curbs, or headers. Finish grade in shrub areas shall be 2 1/2-inches below adjacent surfaces. Exceptions may be made when drainage conditions require flush grades, as directed by the Architect.

G. Compaction: Soils in planted areas shall be loose and friable, yet firm enough that no settling occurs from normal foot traffic or irrigation.

3.04 FIELD OBSERVATION:

A. It is the Contractor's responsibility to contact the Architect 48 hours or two working days in advance of each agreed observation or conference.

B. Schedule for On-Site Reviews: at completion of finish grading and prior to any planting operations.
   1. See “Site Observation” in Part 3 of Section 329300-Landscape Work to coordinate inspections and review of work.

END OF SECTION

SECTION 329300
LANDSCAPE WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Soil Prep and Fertilization.
B. Planting Operation.
C. Planting Materials.
D. Topsoil and Planter Mix.
E. Agronomic Testing.
F. Drainage Materials.
G. Mulching.
H. Sod
I. Pruning
J. Tree stabilization.
K. Edgings.
L. Root Barriers.

1.02 RELATED REQUIREMENTS

A. Division 01 Temporary Tree and Plant Protection
B. Division 12 Section Site Furnishings.
C. Division 31 Section Site Clearing
D. Division 32 Section Landscape Grading
E. Division 32 Section Landscape Irrigation
F. Division 32 Section Landscape Maintenance

1.03 REFERENCE STANDARDS

A. American Association of Nurserymen, Inc. (AAN)
    1. American Standard for Nursery Stock, latest edition (ANSI).

1.04 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
B. Bio-filtration Planting Soil: Imported specialty Soil manufactured offsite by XXXXX required for storm water infiltration.
C. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of exterior plant required.

D. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Sub-grade Elevations: Excavation, filling and grading required to establish elevations is shown on drawings. Coordinate all work with grading contractor in order to arrive at rough grades that will allow tolerance for topsoil in planting areas, soil amendments and ornamental mulch as required in other sections of this specification. Contractor to assume tolerance of rough grades established at ± 0.09 feet (less than 1 tenths of a foot)

G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

H. "Diameter at breast height" (DBH) is measurement for tree trunk caliper.

I. Multi-Stem: Where three or more main stems arise from the ground from a single root crown or at a point right above the root crown.

J. Planting Soil: Native or imported topsoil; mixed with soil amendments.

K. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

L. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

M. Pruning: As designated on contract drawings. Items not specifically indicated or specified, but normally required to conform with such work, are considered part of the work.

1.05 SUBMITTALS

A. WITHIN 30 DAYS OF START OF THE ROUGH GRADING OPERATIONS:
   1. Submit a certificate indicating all plant material has been secured for the project and is available.
   2. Submit documentation that all plant material has been ordered in accordance with Article 1.06 of this section.

B. CERTIFICATION: Submit the following:
   1. Certificates of inspection as required by governmental authorities when transporting materials into the state.
   2. Bulk Materials: Submit a certificate of delivery for all material in containers or bulk.

C. TEST REPORTS: Submit the following:
   1. Agronomic Soils Laboratory Test Report(s) including required amendments and maintenance recommendations.

D. PRODUCT DATA: Submit the following:
   1. In accordance with Division 1 Section "Submittal Procedures", submit complete manufacturer descriptive literature and specifications for proprietary materials and any additional items required by the Architect. Prior to start of construction and submittals; furnish to the Architect the list of items to be submitted and reviewed.
      a. Soil Amendments (as identified in Agronomic Soils Report).
      b. Fertilizer (as identified in Agronomic Soils Report).
      c. Plant Tablets.
      d. Stakes and Guys.
      e. Tree Ties and Vine Ties.
      f. Mulch.
      g. Edging Material.

h. Filter Fabric.
i. Drainage Materials.
j. Other soil additives per Agronomic Soils Report.
k. Submit other data substantiating that materials comply with specified requirements. Such certificates may be tags, labels, and/or manufacturers literature. All submittals shall be reviewed and accepted by the Architect before contractor begins work.
l. Substitution Request
    1) If any plant specified is not obtainable, submit a written substitution request to the Architect during the bidding period.
    2) Substitutions of plant material will not be permitted unless accepted in advance in accordance with the provisions of Division 1 Section "Product Requirements."
    3) The Contractor is responsible for contract growing all required plant material for to project to ensure availability in the size and requirements of the project.
    4) All substitution requests for any material must be made during the bid process. No substitution requests will be permitted after the bid process or during.
m. With submittal of Bid Documents, submit complete list of plant materials to be provided, including unit prices for plants and for installation. Include:
    1) Quantity.
    2) Size.
    3) Botanical Name.
    4) Plant Unit Price.
    5) Installation Unit Price.

2. PLANTING SCHEDULE: Submit proposed planting schedule at least two months prior to planting any materials, indicating dates for each type of landscape work coinciding with normal seasons for such work. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. If dates need to be revised after acceptance of planting schedule, document reasons for delays and submit for acceptance.
3. Submit two photos of each tree(include DBH, height and spread), shrub(include height and width) and groundcover(include height and width) with a person in the image to be used on the project to the architect for review. Photos are to be of the actual material tagged, or secured and that will used for the project at the sourced nursery. No plants may be delivered or planted prior to approval by Architect.

1.06 QUALITY ASSURANCE

A. QUALIFICATIONS
1. Nursery Qualifications: Regularly engaged, for the preceding ten years, in the production of planting materials equivalent in species and size to those required.
    a. Stocked, and having a demonstrated ability to provide plant materials required within the constraints of the accepted construction schedule.
    b. Landscaper's Qualifications: Regularly engaged and specializing, for the preceding ten years, in the installation and maintenance of planting materials equivalent in species and size to those required.
        1) Capable of furnishing a verifiable list of not less than five projects of equivalent type successfully completed within the preceding two years.
        2) Subcontracts: Landscape work to a single firm specializing in landscape installation.
2. Pre-Installation Conference: Schedule in advance of beginning work of this section. Arrange for attendance by Owner, Architect, and landscaping subcontractor. Review intent of Contract Documents and resolve conflicts. Prepare minutes of conference and distribute to attendees within five (5) days.
3. Source Quality Control

a. General: Comply with regulations applicable to shipping of landscape materials.
b. Analysis and Standards: All materials shall be of standard, approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacture's guaranteed analysis. The Contractor shall supply the Architect with a sample of all materials accompanied by analytical data from an approved laboratory source illustrating compliance of bearing the manufactures guaranteed analysis.

4. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
5. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
   a. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
6. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 3/4-inches (19 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
   a. Obtain topsoil only from naturally, well drained sites where topsoil occurs in a depth of not less than 4"; do not obtain from bogs or marshes. All topsoil is to be tested and analyzed by an independent laboratory before delivery to site, as indicated in Article 3.03.
7. Contractor shall provide the Architect with location of soil, crops previously planted on such soil within the last two years, and the USGS soil survey classification and name.
8. Trees, Shrubs and Plants: Provide trees, shrubs and plants of quantity, size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1-1980 "American Standard for Nursery Stock". Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free from disease, insects, insect eggs, larvae and defects such as knots, sun-scald, injuries, abrasions, overlapping surface roots, or disfigurement. Central leaders of all trees shall be intact, undamaged, with evenly spaced lateral branches.
   a. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above the ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
9. Label all trees and shrubs with securely attached waterproof tag bearing legible designation of botanical and common name. Where formal arrangements and consecutive order of trees is shown, select stock for uniform height/spread, and label with number to assure symmetry in planting.
10. Stock Review: The Architect will review trees and shrubs at site before planting with requirements for genus, species, variety, size and quality. The Architect retains right to further review trees and shrubs for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of the work. Remove rejected vegetation immediately from project site. Contractor shall request review of such stock by the Architect by delivering notice, in writing, 72 hours in advance.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver exterior plants freshly dug.

B. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

C. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.
   1. Protect plants from sun or drying winds. Protect and maintain plants that cannot be planted immediately upon delivery.
   2. Do not drop plant material.
   3. Do not pick up container planter material by stems or trunks.
   4. Protect from wind.
   5. Water as required.
   6. Do not prune trees and shrubs before delivery except as approved by Architect. Do not bend or bind trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery, and provide protection on site from traffic, pedestrians, and deleterious effects of climate while planting operations are in progress. Dropped or damaged stock will not be accepted.
   7. Deliver trees and shrubs after preparations for planting have been completed and plant immediately after approval of plant materials locations. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture. Do not remove container grown stock from containers until planting time.
      a. Do not pick up plants by stems or truck. Handle planting stock by root ball.
      b. Do not remove container - Grown stock from containers before time of planting.
      c. Water root systems of exterior plants stored onsite with a fine-mist spray.
      d. Water as often as necessary to maintain root systems in a moist condition.
   8. Plant material shall not be stored on the jobsite for more than 48 hours before planting. Contractor shall schedule nursery deliveries in sub-groups as necessary to comply with this requirement.
   9. Deliver accessory materials in manufacturer's original, unopened packaging with identifying labels affixed and legible in accordance with state law. Deliver plants with identifying tags affixed. Contractor shall notify Architect 72 hours in advance of plant material delivery for observation. Review plants with Landscape Architect to confirm that they are the plants which had previously been tagged and supplied. The Architect reserves the right to reject the following:
      a. Plant materials not identifiable as previously selected.
      b. Materials not accompanied by required certificates.
      c. Plant materials where damage to rootball, trunks, or desiccation of leaves has been caused by inadequate protection during delivery.
      d. Plant material not matching the form, shape, or growth habit required for the design intent of the Project.
      e. Horticultural or visual defects in material.
      f. Plant material pruned prior to delivery.
      g. Plant material with detrimental pests.

1.08 PROJECT CONDITIONS

A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

1. Planting Restrictions: Coordinate planting periods with maintenance periods to provide required maintenance from date of substantial completion.
    a. Plant or install materials during normal planting seasons for each type of landscape work required.
2. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed without having detrimental effects on the plant material, or finished product.
3. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns unless otherwise acceptable to Architect.
    a. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.
4. Contractor shall verify locations of all existing utilities, whether shown on plans or not. The Contractor shall notify members of Underground Service Alert (DigAlert) two (2) working days in advance of performing any excavation work by calling the toll-free number 1-800-227-2600 or 811.
5. After determining location of underground utilities, perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
6. When conditions detrimental to plant growth are encountered, such as rubble fill, hardpan condition, adverse drainage conditions, or obstructions, notify the Architect before planting. Remove all material deemed unsuitable for plant growth as directed by the Architect.
7. No landscape materials may be planted before an irrigation operation and coverage test is completed by the Architect.
8. No landscape materials may be planted before finish grade is reviewed by the Architect.
9. Existing Trees:
    a. Prior to the beginning of any clearing, grubbing, trenching, or excavation on site, the general contractor, grading contractor, project arborist, landscape contractor, and the Architect shall meet in a pre-construction conference to discuss grading near existing trees.
    b. The contractor shall protect all existing trees and shrubs scheduled to remain against injury or damage, including cutting, breaking or skinning of roots, trunks or branches. No blasting of rock shall occur in any area adjacent to existing trees without prior written consent of the Architect.
    c. No trees or shrubs are to be removed, trimmed, or cut without prior approval of the Architect.
    d. Prior to the beginning of the clearing and grading phase of the project, a continuous, temporary, six foot (6') high chain link fence shall be erected around the drip line of all trees scheduled to remain, unless otherwise specified by the Architect. The temporary fencing shall be erected prior to commencing any other work on the project. No construction activity shall be allowed within the limits of this fencing unless directed by the Architect. The temporary fencing shall remain in place during the entire construction period and shall not be removed until directed by the Architect.
    e. Grading beneath trees to be saved shall be given special attention. Every effort shall be made to avoid creating conditions adverse to the tree’s health. The natural ground within the drip lines of trees to be preserved shall remain as undisturbed as possible. Grading within the protected root zone of trees to be preserved will not be permitted unless specifically approved by the Architect prior to beginning of proposed grading.
    f. If during construction or grading (grading, excavation, etc.) tree roots of 2" in diameter or greater are encountered, work shall stop immediately and a Certified Arborist, approved in advance by the Architect, shall be contracted for a root inspection. Root cutting of any roots over 2" in diameter must have prior approval from the Architect. All cuts are to be made with appropriate equipment, as to not affect the plant material.

g. Major roots one inch (1") or greater in diameter encountered within the drip line of the tree in the course of excavation or trenching shall not be cut and shall be kept moist and covered with earth as soon as possible. Shredding of roots or damaged caused by trenching or grading equipment is not permitted.
h. Roots one half inch (1/2") to one inch (1") in diameter which are severed shall be trimmed cleanly and covered with earth as soon as possible.
i. All trenching beneath the drip line of trees to remain shall be done with hand tools only. No mechanical trenching or excavation is allowed within the drip line of existing trees at any time, or where roots are encountered outside the dripline of the tree.
j. Branches interfering with construction but not designated for removal may be removed only as directed by the Architect.
k. Any pruning, cutting, or trimming of any trees will be performed by an International Society of Arboriculture Certified Arborist or certified tree worker or in accordance with the National Arborist Association and/or International Society of Arboriculture pruning standards. Cutting of 2" diameter limbs or greater or major dead wooding shall require approval of the Architect.
l. Trees or shrubs scheduled to remain and damaged by construction operations shall be repaired by the contractor in a manner acceptable to the Architect. Damaged trees and shrubs shall be repaired promptly to prevent progressive deterioration. Repair or replacement of trees and shrubs shall be at the contractor's expense as determined by the Architect. Contractor shall be held fully liable for damage caused to trees and shall be assessed fees based on the International Society of Arboriculture "Guide for Plant Appraisal", as determined by the project Arborist; fees will be assessed for: 1) any injury to the trunk, limbs, or root system, and (2) for the value of any tree requiring removal subsequent to injury or treatment that varies from these Specifications.
m. A permit from the City Arborist may be required prior to pruning or removing any trees, as required by applicable codes or ordinances.
n. Parking of vehicles, equipment or storage of materials under the drip line of existing trees shall not occur at any time.
o. Wash all existing and new trees weekly to remove dust and debris during construction.

1.09 SCHEDULING

A. Within 30 days after the commencement of initial grading, furnish documentation to the Architect that all plant material has been secured for the project and is available. Contractor shall be responsible for payments and deposits required by the grower or plant consultant to secure, maintain, and grow plant material indicated on the Contract Drawings.

1.10 WARRANTY

A. Special Warranty: Warrant all plant material in writing where installer agrees to repair or replace plantings and accessories that fail in materials, workmanship or growth within specified warranty period.
   1. Failures include, but not limited to, the following:
      a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by owner.
      b. Structural failures including plantings falling or blowing over including during high wind events.
      c. Faulty operation of tree stabilization edgings tree grates.
      d. Deterioration of metals, metal finishes and other materials beyond normal weathering.
      e. Material not thriving.
      f. Warranty periods begin from date of final completion:

1) Trees, vines, shrubs: One year.
2) Ground cover and turf: One year.

2. Warrant plant material, installed, or relocated under the contract, in writing, for a period of one year (after beginning of maintenance period) against defects including death, and unsatisfactory growth, except for defects resulting from neglect, abuse or damage by others.
3. Remove and replace trees, shrubs or other plants found to be dead, yellowing, defoliating, or in unhealthy condition, or other defective materials during warranty period at no additional cost to the Owner. Replace trees and shrubs, which in the opinion of the Architect, are in unhealthy condition at end of warranty period. The Architect shall be the sole judge as to the condition of the material. All replacement materials and installation shall comply with the drawings and specifications. Another inspection may be conducted at end of warranty period to determine acceptance or rejection.
4. Upon receipt of written notice from Owner of the loss of any warranted plant materials during the warranty period, the subject plant materials shall be promptly replaced with the same species originally planted, and of a size closely approximating the size of the plant, if normal growth had occurred since the original planting. Replacements shall be subject to the requirements of this specification.
5. When plants are replaced, advise the Owner, in writing, of the new establishment maintenance period equal to the one year.
6. Plant material must be replaced within ten (10) days of written notification, and shall be installed in accordance with these specifications.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Design is based on the use of products manufactured by the following.

B. California (Southern)
1. Stabilizer, Inc. Phoenix, AZ 800-325-5360.
2. Conwed Designscape, Ladyscape, MI, 714-532-5548/800-833-4798.
3. MacLean Civil Products, Fort Mill, SC 800-925-5360.(check for local distributor)
4. Agrono-Tec Seed Co., Wildomar, CA, 800-543-4109.
5. Aguiñaga Fertilizer Co., Inc., Irvine, CA, 949-786-9558.
6. Ecology Controls, S&S Seeds, Camarillo, CA, 805-684-0436.
7. Gail Materials, Corona, CA, 951-664-6106.
8. KRC Rock, San Marcos, CA, 800-427-0572.
9. Landscape Forms, represented by
   a. David Silverman & Associates, 818-541-6691. Los Angeles, (Orange, Kern, Riverside, Santa Barbara, San Bernardino, San Luis Obispo, and Ventura Counties)
   b. Grant and Associates, 858-327-3017 (San Diego)
10. Mirafi, Inc., Charlotte, NC 800-438-1855, represented by James Heidt & Associates, Montrose, CA, 818-248-9677/800-233-0512.
11. NDS Drainage Products, 800-726-1998.
12. Quality Turf, Temecula, CA, 800-721-4800.
13. Pacific Sod, Camarillo, CA, 800-762-3027.
14. Permaloc Corporation, Holland, MI, 616-399-9600.
15. S&S Seeds, Camarillo, CA, 805-684-0436.
16. Soil and Plant Laboratory, Inc., Orange, CA, 714-282-8777.
17. Southern California Organic Fertilizer Company, El Monte, CA, 714-750-3830.
18. Southland Sod Farms, Port Hueneme, CA, 805-488-3585.

19. Stabilizer, Inc., Phoenix, AZ, 602-952-8009/800-336-2468.
20. V.I.T. Company, Escondido, CA, 760-480-6702.
21. West Coast Turf, Las Vegas, NV, 800-649-8873.
22. Whitecap, Inc., Santa Ana, CA, 714-258-3300.
23. Whittier Fertilizer, Pico Rivera, CA, 310-699-3461.
24. EPIC Plastics, Cerritos, CA, 562-403-3848.
25. Wallace Labs, El Segundo, CA, 310-615-0116.
26. Whittier Fertilizer, Pico Rivera, CA, 562-699-3461.
27. Materials shall be the products of one manufacturer and shall be either the ones upon which the design is based, or the products of manufacturer accepted in advance. No substitutions will be permitted.

2.02 SOIL

A. TOPSOIL: Site to be rough graded to elevations shown on Civil Drawings. Topsoil will be required behind curb areas and in planting area. Provide on-site, import, or non-processed topsoil in planting areas as needed to complete rough grading which is fertile, friable, and natural loam in accordance with Article 2.03. Topsoil shall be from agricultural sources, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 3/4-inch in any dimension, and other extraneous or toxic matter harmful to plant growth.

B. All topsoil to be used for planting, regardless of whether import or on-site in origin, shall be tested as described in Part 3 of this Section.

C. Biofiltration Planter Soil
   1. Pre-manufactured soil as purchased by Gail Materials.
      a. The soil shall be a blend of 4 parts by volume washed sport sand to 1 part sandy loam topsoil. The gravel content shall not exceed 15% by weight with the largest allowable particle not exceeding 1/4 inch.
      b. Chemistry:
         1) The pH shall be in the range of 6-8.0.
         2) Salinity shall not exceed 3.0 dS/m.
         3) Sodium: Sodium absorption ratio (SAR) shall not exceed 5.0
         4) Boron shall not exceed 1 ppm.
      c. Amendments:
         1) The top 6 inch layer the following shall be uniformly blended by means of a pub mill or equal.
            (a) Amount/cubic yard
               (1) 10% by volume of Reed Sedge Peat Moss
               (2) 25% 8X20 Lassenite Pozzolan
               (3) 15 lbs. 6-20-20 fertilizer
               (4) 50 lbs. Gypsum
         2) For the depth below 6 inches uniformly blend by means of a pug mill or equal
            (a) Amount/cubic yard
               (1) 10% by volume AXIS medium grade.
      d. Location(s)
         1) Use in designated infiltration planter areas and bioswale areas, see planting plans.
         2) Depth shall be per details.
         3) Available through Gail Materials, Corona, CA (951) 667-6106
         4) Contact: Dave Dzwilewski

2.03 SOIL AMENDMENTS

A. The initial application of fertilizers and amendments to be tilled into the soil during soil preparation operations shall be established after soil testing has been conducted by Contractor. An estimated quantity is indicated below for bid purposes only. This estimated quantity does not include mulching, fertilizer tablets, additional topsoil necessary to meet specified grades and fertilizer applications for after planting. After soils analysis recommendations are made to the Architect quantifying the actual amount of amendments required and recommendations have been accepted by the Architect, the Contractor shall, without delay, determine any cost impacts whether credit, no change, or addition, to the Contract Amount. As an integral part of the bid for Landscape Work, provide a Lump Sum bid amount for fertilizers and amendments as described below.

B. Application Rates (FOR BID PURPOSES ONLY):
   1. Sixty (60) lbs. of Tri-C Humate per 1,000 square feet.
   2. Nineteen (19) lbs. of 6-20-20 fertilizer per 1,000 square feet.
   3. Six (6) cubic yards of Aguiñaga GPS2, nitrogen stabilized compost per 1,000 square feet.
   4. 50-lbs Agricultural Gypsum, per 1,000 square feet.

C. Actual amendment rates and type shall be per soil test recommendations.

D. Imported Topsoil
   1. Provide natural, fertile, friable soil free from stones, noxious weeds, seeds, roots, subsoil or other material detrimental to normal plant growth. Topsoil acidity range (pH) shall be between 6.5 and 7.5 containing a minimum of 4 percent and a maximum of 25 percent organic matter.
   2. Reuse surface soil stockpiled onsite. Verify suitability of stockpiled surface soil to produce top soil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
      a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain top soil displaced from naturally well drained sites where topsoil occurs at least 4 inches deep; do not obtain from [agricultural land], bogs or marshes. Obtain soil from local sources acceptable to the Architect.
      b. Silt plus clay content of soil shall not exceed 15 percent by weight with a minimum 95 percent passing a 2 millimeter sieve.
   3. Obtain imported topsoil from local sources acceptable to the Architect.
   4. Silt plus clay content of soil shall not exceed 15 percent by weight with a minimum 95 percent passing a 2-millimeter sieve.

E. Organic soil amendment:
   1. Organic soil amendment shall be Aguinaga GPS2.
   2. Particle Size:
      a. 90-100 percent passing 6.35 mm standard sieve.
      b. 80-100 percent passing 4.75 mm standard sieve.
   3. Salinity: The saturation extract conductivity shall not exceed 6.5 milliohms/centimeter at 25 degrees Centigrade as determined by saturation extract method.
   4. Iron Content: Minimum 0.08 percent dilute acid soluble iron on dry weight basis.
   5. Actual organic content shall be a minimum of 280 pounds (lbs.) per cubic yard.

F. Fertilizers
   1. Tri-C Humate. Provide per manufacturers specification.
   2. Fertilizer Tablets: Fertilizer Tablets: The following is to be used in the planting of container grown material. Follow manufacturer's application rates.
      a. Best-Paks "20-10-5" fertilizer packets. Packets to be made up of a minimum of 20% Nitrogen, 10% Phosphorus, 5% Potash. Use 1 Pak per 1-gallon container, (G.C.), 3 Paks per 5 G.C., 9 Paks per 15 G.C. and 12 Paks per boxed specimen. Evenly distribute as shown in details.

3. Commercial Fertilizer: First Quality Commercial Fertilizer, as specified in Agronomic Soils Report.

G. Related Materials:
1. Pre-Planting Herbicide: Phydura, or equal.
2. Pre-Emergent Weed Control: Ronstar-G, Treflan, Eptam, Vegitex, or equal.
3. Peat Moss: Sphagnum peat moss, Canadian or European variety, free from alkali.
4. Soil Sulfur: First quality commercial grade.
5. Ferrous Iron Sulfate: Chelated first quality commercial grade.
6. Agricultural Gypsum: First quality commercial grade.
7. Best "Ammonium Phosphate" 16-20-0 with net less than 16% total nitrogen, 20% available phosphoric acid and 0% soluble potash.
8. Good Humus.

2.04 PLANT MATERIALS

A. Quality: Provide trees, shrubs, and other plants of size, form, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock".

B. Deciduous Trees: Provide trees of height and caliper scheduled or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed.
1. Lateral scaffolds shall be radially distributed around the trunk. The lateral branch shall be no more than 2/3 the diameter of the trunk. Trunk to be measured 1" above the branch (lateral scaffold).
2. The minimum acceptable length of the most recent season's shoot growth for slow growing trees shall be not less than 8"; for fast growing trees not less than 12".
3. The minimum acceptable height of trees is 6'-0" when planted, or as determined by Architect.

C. Needle Leafed and Broad Leafed Evergreen Trees: Provide evergreens of sizes shown or listed. Where dimensions are shown, they indicate minimum spread for spreading and semi-spreading type evergreens and height for other types, such as globe, dwarf, cone, pyramidal, broad upright, and columnar. Provide normal quality evergreens with well-balanced form complying with requirements for other size relationships to the primary dimension shown.
1. The minimum acceptable height of trees is 6'-0" when planted, or as determined by Architect.

D. Multi-Trunk Trees: Provide sizes shown or listed. Tree is to have a minimum of three (3) dominant trunks with appropriate caliper size and adequate spread.
1. Shrubs: Provide shrubs of the size shown and with not less than the minimum number of canes required by ANSI Z60.1 for type of shrub required. Provide container grown stock.

E. Ground Cover: Provide plants established and well-rooted in removable containers, in flats, or integral peat pots and with not less than minimum number and length of runners required by ANSI Z60.1 for the size shown or listed.

F. Vines: Provide vines with good, well-established root systems within the container, and devoid of any abrasions, and or damage to stem.

2.05 SOD

A. Lawn Sod:
1. Nursery-grown sod shall have the following characteristics:
a. Sod for planting areas shall be dense, healthy, field-grown on sand fumigated soil with the grass having been mowed at 1-inch height before lifting from field.

b. Sod for grass pave areas shall be dense and healthy, grown on a sand bed thin cut and washed.
c. Sod shall be dark green in color, relatively free of thatch, free from disease, weeds and harmful insects.
d. Sod shall be reasonably free of objectionable grassy and broadleaf weeds. Sod shall be considered weed free if no more than 2 such weeds are found per 100 square feet of sod.
e. Sod shall be rejected if found to contain the following weeds: common Bermuda grass, quack grass, Johnson grass, nimble weed, thistle, bindweed, bentgrass, perennial sorrel, and bromegrass.
f. Sod variety shall be:
    1) Turf Grass: Tiffway II, Bullseye, Bandera, GN1, Medallion Plus 90% Tall Fescue/10% Bluegrass Blend, as produced by West Coast Turf / Pacific Sod.
    2) Molate Fescue: No Mow Fine Fescue Blend, as produced by Pacific Sod.

2.06 MISCELLANEOUS LANDSCAPE MATERIALS:

A. Tree Stakes: Provide stakes of sound new lodgepole pine 2 inch minimum diameter for 15 gallon to 24 inch box size trees; 3 inch minimum diameter for 36 inch box and larger. Lodge pole minimum height, as indicated on Contract Drawings. Stakes shall have been treated with copper napthanate or ACQ (alkaline) or Ca-B (copper azole) to a minimum wood depth of 1/16". All stakes shall be free of knots larger then 1/2" in diameter, holes and other defects.

B. Tree Straps: Provide VIT black tree straps. Tree straps shall be attached to tree stake as shown in staking detail on the plans, color to be black.
    1. VIT "Cinch-Tie" CT32 for 24-inch box size and smaller tree.
    2. VIT "Twist Brace" TB36 for 36-inch box size and larger tree.

C. Vine Ties: Plastic vine ties, as specified on plans.

D. Headers and Edging
    1. Concrete edger: Dimension as specified on plans, poured in place concrete edger, color per plan.
    2. Aluminum Edging
        a. CleanLine as manufactured by Permaloc Corporation.
            1) Size: (thickness x height)
            2) Color and Finish: Mill, Black Duraflex, Bronze Duraflex, Black anodized finish.
            3) Stakes: 12 inch long aluminum
        b. CleanLineXL as manufactured by Permaloc Corporation.
            1) Size: (thickness x height)
            2) Color and Finish: Mill, Black Duraflex, finish.
            3) Stakes: 18 inch long aluminum

E. Mulch
    1. Bark Mulch:
        a. Type 1- Mulch shall be shredded bark mulch, as manufactured by Whittier Fertilizer, Pico Rivera, CA.
            1) Mulch shall consist of shredded bark mulch with a particle range of 2-3/4-inch to 1-inch in size.
        b. Type 2- Mulch shall be Medium decorative bark, as supplied by KRC Rock. 1-800-572-7625.
    2. Weed Control Fabric: Place Mirafi Mirascape landscape fabric below rock mulch or as shown on drawings. Overlap all seams 12" minimum and pin down every 36" typical. Mirascape fabric available from: Towns & Associates, 800-222-6036

F. Root Control Barriers: High-density polyproylene root control planter. Acceptable products include:
   1. Deep Root; Deep Root Corporation.
   2. Size as specified on drawings.

G. Drainage Materials
   1. Gravel in raised planters on structural slab and in pots shall be clean, coarse 3/8-inch to 3/4-inch diameter.
   2. Gravel for tree drainage shall be 3/4" diameter coarse clean gravel.
   3. Synthetic filter membrane cover over drainage course shall be woven synthetic fabrics.
      a. Model 140N, as manufactured by Mirafi.
   4. Drain Pipe at trees: 4-inch diameter PVC perforated(within gravel), and non-perforated PVC drain pipe(stand pipe) with PVC adaptor connected to 4-inch ABS female reciever with 4-inch black ABS cleanout plug.

H. Sand: Washed plaster sand.

I. Jute Netting: A uniform open plan weave, single jute yarn not varying in thickness by more than 1/2 of its normal diameter, in rolled strips approximately 50 to 75 yards long and 50 to 60 inches wide. Contractor shall submit sample for approval prior to installation.

J. Staples: 11 gage with 1-inch top and 6-inch legs.

K. Sod Pegs: 1-inch square by 6-inch long pine or 6-inch lengths of lath.

L. Weed Control: Phydura, or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected, and Architect has reviewed and accepted materials as defined within the section.

3.02 SITE OBSERVATION SCHEDULE

A. General: Notify Landscape Architect at least 3 days in advance when requesting on-site reviews.

B. Prior to commencement of site visits, items noted in previous observation reports shall have been either completed or remedied, unless such compliance has been waived. Failure to complete prior tasks or failure to prepare adequately for scheduled observations shall obligate Contractor to reimburse Architect for additional hourly services, plus transportation costs

C. Schedule For On-Site Reviews by the Landscape Architect:
   1. Pre-construction conference with general contractor, grading contractor, landscape contractor, project arborist and landscape architect to discuss grading and protective measures to be followed in the vicinity of existing trees, or existing structures.
   2. At completion of finish grading, and roto-tilling
   3. Review of irrigation coverage prior to installation of any planting material.
   4. At completion of fine grading and at delivery of plant materials, together with plant layout; prior to excavating pits.
   5. Review of drainage system, standpipes, and plant material locations.
   6. After planting pits have been excavated, but prior to backfilling. Provide one sample plant pit mock up for review.

7. After initial planting operations (One tree with each type of specified staking shall be approved prior to planting of trees).
8. Stake all tree locations for review.
9. See "Final Review and Acceptance" at the end of Part 3 in this Section for final site observations and acceptance of work.

3.03 TESTING

A. Planting Soil: Agronomic Soil Testing
   1. Test shall be paid for by the Contractor. (SoCal)Testing lab shall be:
      a. Wallace Labs, El Segundo, CA
      b. Waypoint Analytical, Anaheim, CA
   2. Agronomic Soils Testing
      a. Take (6) six samples of site soil at a depth of 6 to 12 inches, within proposed planting areas, after completion of final grading and prior to weed control and soil preparation.
      b. Take samples to agronomic soils testing laboratory indicated above for soil evaluation.
      c. Request testing for fertility and suitability analysis with written recommendations for soil amendment, fertilizer and chemical conditioners, application rates for soil preparation, planting backfill mix, pot-soil mix, hydro-spray, and post-maintenance fertilization programs.
      d. Soils report recommendations shall take precedence over the amendment and fertilizer application rates specified in this section.
      e. Submit testing laboratory's interpretation, recommendations, and comments to Architect within 14 days after the completion of rough grading.
      f. Furnish a soils analysis of import soil, and organic soil amendment prior to backfill.
         1) Submit soil testing laboratory's findings to Architect within 5 days prior to backfilling.
      g. Take six additional soil samples after completion of planting in the soil preparation and backfill mix areas, to be determine effectiveness to amendments prior and during planting. Submit to the testing laboratory the original amendment specification with previously issued bulletins for soil amendments and installation procedures. Re-apply necessary amendments based on recommendation of new soils test.

3.04 PREPARATION

A. Final Grades
   1. Finished grading shall insure proper drainage of the site. Conform to Division 31 Section "Earthwork" and Division 32 Section "Landscape Grading."
   2. The following areas shall be graded so that the final grades shall be established below adjacent paved areas, sidewalks, valve boxes, headers, clean outs, drains, manholes, etc. before placement of mulch as follows:
      a. Shrub/Groundcover Areas: 2-1/2 inches.
      b. Turf areas: 1-inch.
      c. Surface drainage shall be away from all building foundations, 2% minimum.
      d. Dispose of excess or unacceptable soil from the site at no expense to the Owner.
      e. Verify that final grades have been established prior to beginning planting operations.
   3. Parking Lot Planters and areas adjacent to hardscape.
      a. All aggregate base rock, lime-treated soil, soil sterilents, and other non-organic materials shall be removed from all parking lot planter areas down to the level of native soil. Scarify native soil to a depth of 12 inches and backfill planters to specified finish grade with native or approved topsoil and amend as specified.

b. Remove all concrete overpours or any material that may prohibit the placement of plant material, irrigation, grates, root barriers, or any other conflicting material.

4. Lightweight soil mix shall be sampled after mixing and delivery to the site, but prior to filling planters. Submit the original lightweight soil specification to the testing laboratory with previous bulletins for lightweight soil mix. Provide 1-quart of lightweight soil mix for every 65 cubic yards for organic and fertility analyses. Fertility analysis, recommendations and interpretations shall be furnished by the testing laboratory to ensure all specified amendments have been provided. Lightweight soil is to be used only in locations indicated on the Contract Drawings and as approved by the Architect.
5. Protect planting areas from compaction by foot, trucks and heavy equipment.

3.05 PLANTING BED ESTABLISHMENT

A. Preparation Of Planting Area

1. Cross-rip on-grade planting areas to a minimum depth of 12 inches minimum 2 perpendicular directions. Remove stones over ½ inch (13mm) in any dimension and sticks, roots, rubbish and other deleterious matter per Division 32 "Landscape Grading".
2. Where additional soil is needed, place the top 15” with topsoil. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil.
3. Leach soil prior to amending.
4. After approximate finished grades have been established and soil has been leached, soil shall be conditioned and fertilized in the following manner: Soil condition shall, at the rate specified in the approved soils test recommendations, be uniformly spread and cultivated thoroughly by means of mechanical tiller into the top (8) eight inches of soil.
5. Broadcast soil amendments uniformly over surface of the area to be treated. Roto-till the top (8) eight inches of planting areas to evenly distribute the amendments and conditioners into the soil.
6. Retest as required to verify leaching was successful. All soil areas shall be compacted and settled by application of irrigation to a minimum depth of six (6) inches prior to any plant materials being installed.
7. At time of planting, the top 12 inches of all areas to be planted shall be free of stones, stumps, or other deleterious matter one 1/2 inch in diameter or larger, and shall be free from all debris, or similar objects that would be a hindrance to planting and maintenance.
8. Weed Eradication:
   a. Manually remove all existing vegetation in planting areas and dispose of it offsite.
   b. Fertilize planting areas with urea 30-0-0 commercial fertilizer at the rate of 0.5 pounds per 1000 square feet.
   c. Water planting areas thoroughly and continuously(by irrigation system, hand/hose, water truck, or other) for a period of 3 consecutive weeks, or until the weed seed have germinated. If accepted in advance by the Landscape Architect, employ a specific watering duration and frequency program designed to germinate residual weed seeds.
   d. Discontinue watering process for 2 days. Then apply a non-selective broad spectrum systemic herbicide for perennial weeds.(2 applications minimum) The type of herbicide to be used shall be determined by a licensed pest control applicator. If annual weeds are present, use straight contact herbicide in accordance with pest control applicator's recommendations.
      1) Do not use a pre-emergent herbicide.
   e. Allow sufficient period of time to ensure that weeds are dead. Follow herbicide manufacturer’s directions.

f. Water planting areas thoroughly and continuously (by irrigation system, hand/hose, water truck or other)for a period of 3 weeks. A shorter watering period may be permissible at the discretion of the Landscape Architect. Discontinue watering process for 1 day prior to the second application of the herbicide spraying.(2 applications minimum) Re-apply the spraying operation with straight contact weed killer in accordance with pest control adviser's recommendations.
   1) Do not use a pre-emergent herbicide.
   2) Avoid irrigation for a minimum of 4 days for effective final weed kill.
g. Clear desiccated weeds from the area.
h. Water Planting areas thoroughly and continuously for 3 consecutive days to saturate upper layers of soil prior to planting operations.
i. Allow planting area soil surface to dry out for I day only prior to the planting application. Exercise care to not allow the soil surface to be either super-saturated with water or bone dry prior to the planting installation. Ensure moderate residual moisture within the top 1/4 inch of the soil surface.
j. The hydraulic equipment used for pesticide applications shall consist of an ISO-gallon minimum capacity fiberglass tank with complete mechanical agitation. The pump capacity shall be 10 gallons per minute while operating at a pressure of 100 pounds. Per square inch.
k. Distribution lines shall be large enough to carry the volume of water necessary for even, chemical distribution. The spray nozzle must cover a IS-foot swath, with a minimum output of 5 gallons per minute at 80 pounds per square inch.

9. Pre-emergent Weed Control: Immediately after planting, apply pre-emergent weed control to planted areas which will not be seeded.
10. Excavation For Trees And Shrubs
    a. Excavate pits, beds, and trenches as shown in details on the drawings.

B. Preparation for Lawn Areas: Limit preparation to areas which will be planted promptly after preparation.
1. Prepare planting area as described in 3.05 A.
2. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Establish smooth uniform surface. Limit fine grading to areas which can be planted immediately after grading.
3. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.
4. Restore lawn areas to specified conditions if eroded or otherwise disturbed after fine grading and prior to planting.

3.06 BIOFILTRATION PLANTER SOIL

A. The Biofiltration planter soil shall be placed on the planter area and firmed to a depth of as shown on the drawings. Mix shall be moist when spread to discourage migration in to the subgrade and to assist forming.

B. Soil mix shall be separated from drainage courses with geotextile fabric equal to Mirafi 140N.

C. See Grading Plans for locations and depths and Planting plans for plant material.

3.07 ROOTZONE FOR SAND BASED TURF

A. The thoroughly mixed root zone material shall be placed on the areas designated for turf (except for areas designated for grass pavers) and firmed to a uniform depth of 6 inches (300mm) with a tolerance of +1/4-inch (6mm). Mix shall be moist when spread to discourage migration in to the subgrade and to assist forming.

B. Soil mix shall be separated from drainage courses with geotextile fabric equal to Mirafi 140N.

C. See Planting Plans for turf locations.

3.08 JUTE MESH

A. Make check slots before the netting is rolled out. Dig a narrow trench across the slope perpendicular to the direction of the flow. Fold jute, the same length as the trench, and press together. Location of check slots shall be a maximum of 50 feet apart.

B. Installation: Roll netting parallel to slope contours. The netting shall completely cover all areas as indicated on Contract Drawings. Overlaps shall be ample and well stapled.
   1. Lay netting smoothly, and in continuous contact with the soil surface at all points.
   2. Install without stretching. Where one roll of netting ends and a second roll starts, the up slope piece shall be brought over the buried end of the second roll so that there is a 12-inch overlap. Where two or more widths of netting are applied, side by side, the overlap shall be not less than 3 inches.
   3. Staple overlapping edges that run parallel to the direction of the flow at 2-inch intervals. Outside edges, centers, and overlaps on banks shall be stapled across the slope at 6-inch intervals.
   4. Top dress jute netting area with a thin layer of topsoil. After the top dressing, the yarns shall still be visible.
   5. Spread loose topsoils over outside edges of netting to allow for smooth entry of water.
   6. Clods that hold the jute off the ground shall be stamped into the soil. Force jute netting down into depressions and hold there with a staple.
   7. Install plant material through netting.
   8. Maintenance: Maintain jute netting until work on the Project has been completed and accepted and during the 90-day maintenance period. Maintenance shall consist of the repair of eroded areas and the repair or replacement and re-stapling of loose or undermined netting. Replace damaged planting materials as required.
   9. Install jute netting in all areas of 30 percent slope or greater.

3.09 SOD

A. Sod shall be laid with closely fitted joints on a smooth, level surface which has been prepared as previously specified. Ends of strips shall be staggered. On irregular areas, sod shall be laid in both directions from the longest straight line that can be drawn through the area.

B. After a light initial watering immediately after installation, the sod shall be rolled to eliminate all irregularities.

C. After compaction, the sodded area shall be wetted to a soil depth of at least 8 inches.

D. Sod shall be as specified on the Contract Drawings

E. Protect sod from pedestrian traffic for 21 days and from sports activity for 6 weeks.

F. Sod is to be rolled minimum two times or as often as required in two directions with a water ballast roller to remove variations in grade. Sand infill all depresses. Sand to comply with turf manufacturer recommendations.

G. Sod is to be machine placed from “Big Rolls”.

3.10 PLANTING

A. General
   1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Architect.

2. Only as many plants as can be planted and watered on that same day shall be distributed in a planting area.
3. Container shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure acceptance by the Architect before start of planting work. Make minor adjustments as may be requested.

C. Excavation for Trees and Shrubs:
1. Excavate pits, beds and trenches as shown in details on the Drawings.
2. Roughen and score edges of planting pit to eliminate any glazing of the sides of the pit.
3. Field Samples: Prior to planting, prepare one plant pit with standpipe, gravel, filter fabric, and root barriers for each tree size to be reviewed by the Architect.
4. Do not cover standpipes.
5. Excavation for planting shall include the stripping and stockpiling of all acceptable topsoil encountered within the areas to be excavated for trenches, tree pits, plant pits, and planting beds.

D. Container Removal
1. Cut containers on two sides with an acceptable cutter. Do not cut containers with spade or ax. Do not injure the rootball.
2. Carefully remove plants from containers without injury or damage to rootball.
3. After removing plants, superficially cut edge roots with knife on three sides.
4. For plants with sensitive roots, place container intact in flat pit 1½ times the size of a standard plant pit. Insert blades of sharp, needle-nose shears into a drain hole and cut the container bottom away. Remove bottom from pit. Follow with a cut down one side of the container from top to bottom. Repeat cut on opposite side. Fill plant pit with prepared plant pit mixture. Carefully remove the detached pieces.

E. Box Removal:
1. Remove bottom of planting boxes before planting.
2. Remove sides of box without damage to rootball after positioning plant and partially backfilling.

F. Planting Trees and Shrubs: Set container-grown stock, plumb and in center of pit or trench. Set top of rootball 2-inches above finish grade at trees, 1-inch above finish grade at shrubs, or as indicated on Contract Drawings. Do not use plant, if root system has severely kinked or circling roots, or if rootball is cracked, disturbed or broken. If root system is healthy, loosen spiraling roots and set in plant pit.

G. Planting pit shall be backfilled with the following soil conditioner and organic amendment, per cubic yard:
1. Application Rates, (FOR BID PURPOSES ONLY)as determined by contractor's soils tests:
   a. Potassium Sulfate - 0-0-50, ¼-pound
   b. Single Superphosphate - 0-20-0, ¼-pound
   c. Ammonium Sulfate - 21-0-0, ¼-pound
   d. Compost - 15% by volume
   e. Agricultural Gypsum - 1.5 pounds
   f. Good Humus - 15% by volume
2. Final amendments and rates are to be determined by Agronomic Soils Test.

H. When set, place additional fill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 1/2-full, place appropriate number of fertilizer tablets and complete backfill operations.

I. After backfilling, an earthen basin shall be constructed around each plant. Each basin shall be as indicated on the Contract Drawings. Basin shall be of a size suitable for the individual plant. In no case shall the basin for fifteen (15) gallon plant be less than four (4) feet in diameter; a five (5) gallon plant less than three (3) feet in diameter. The basins shall be constructed of amended backfill materials, and shall not be constructed for trees in turf areas.

J. Repeat watering until no more is absorbed.

K. Apply pre-emergent herbicide as per manufacturer's recommendations to all shrub and ground cover planting areas after planting.

L. Mulch all planted areas that do not receive jute netting, other than lawn areas, at not less than 3" thickness of mulch.
   1. Areas with 30% slope and greater shall be protected with jute mesh.

M. Equally space and align trees and shrubs in both directions where designated on Contract Drawings.

N. Pull bark mulch three (3) inches away from the rootballs of all plants to insure proper air circulation.

O. Prune, thin out and shape trees and shrubs in accordance with standard horticultural practices. Prune trees and other plantings only if required. Pruning shall be limited to remove injured wigs and branches, and to compensate for loss of roots during transplanting, but never exceed 1/3 of the branch structure. Never prune without prior review with Architect.

P. Prune shrubs to retain natural character. Unless directed by the Architect, do not prune leaders or apices of any plant material. Do not prune into balled or boxed forms without prior written approval of the Architect.

Q. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

R. Planting Ground Cover
   1. Space plants as shown or scheduled.
   2. Dig holes large enough to allow for spreading of roots and compact area around plant. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover crowns of plants with wet soils.
   3. Mulch areas between ground cover plants with not less than three (3) inch deep mulch.

S. Miscellaneous Landscape Work: Install headers and edgings where shown. See appropriate details.

T. Planting Vines: Plant in accordance with details. Attach vine to vertical elements with vine ties as per manufacturer's recommendations.

U. Tree Staking and Guying: Stake or guy all trees per landscape details, and tie with tree ties as specified. Remove all nursery stakes from trees unless directed otherwise by the Architect. Immediately after planting, stake and guy all trees in accordance with details indicated on Contract Drawings. One tree of each size shall be staked and guyed, and reviewed by Architect prior to continue work.

V. Hardpan Conditions
   1. Where hardpan exists, whether it is in the form of caliche, rock or other impervious matter, and it is within the top 2½ feet of soil, or within the plant pit, use powered equipment to break through completely at each plant location to allow drainage and root growth. Remove hardpan at least 1½ feet greater than the rootball diameter of plant. Backfill with soil mix as specified.
   2. Where hardpan is within the first 12-inches of soil, it shall be completely penetrated for all trees and shrubs.

3.11 CLEANUP AND PROTECTION:

A. During landscape work, keep pavements clean and work area in an orderly condition. Haul away and remove all debris from landscape areas, and do not leave any clippings, and or other material from landscape planting and/or maintenance period.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and/or other trades. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

C. Powerwash all pavement and flatwork as necessary to remove all staining and tire marks and provide a clean surface.

3.12 REVIEW & FINAL ACCEPTANCE

A. General: Notify Landscape Architect at least 5 days in advance when requesting on-site reviews.

B. Site Observation requirements:
   1. Punch list at completion of landscape/irrigation work.
      a. Review of grading, irrigation and planting.
      b. Upon completion of punch list items the Maintenance Period begins.
         1) The maintenance period will not begin until all punchlist items are resolved and acceptance is provided by the Landcape Architect in writing.
   2. Final acceptance of project (at end of Maintenance Period).
      a. Review of grading, irrigation and planting.
      b. Upon completion of punch list items to the Client and Landscape Architect's satisfaction, the work is deemed completed.
   3. Refer to Division 32 Section "Landscape Maintenance."
   4. Replace non-compliant and/or rejected work prior to final observation.
   5. Prior to the date of final observation, Conractor sahll provide the Landdscape Architect with all Record Drawings in accordance with the Plans and Specifications.

3.13 REPLACEMENT

A. All plant material and other materials installed under the Contract shall be warranteed against any and all poor, inadequate or inferior materials and/or workmanship or improper maintenance, as determined by the Landscape Architect, and shall be replaced by the Contractor at his expense. Warranty periods are noted in Part of this Specification.
   1. Replacement: Any materials found to be dead, missing, or not in a satisfactory or healthy condition during the maintenance period shall be replaced immediately. The Landscape Architect shall be sole judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within five (5) days of written notification by the Landscape Architect. All replacement materials and installations shall comply with the Plans and Specifications.
      a. As soon as weather condtions permit, replace work that does not comply with the Plans and Specifications, without cost to the Owner. Remove rejected and non-compliant work and mateirals immediately from the project. Continue specified maintenance period until reinspected by the Landscape Architect and dtermeined to be acceptable.
      b. Any plant missing due to suspected theft shall be replaced by the Contractor. If the Contractor suspects that theft may be a problem, the Contractor shall provide written documentation to the Landscape Architect that security on this site needs to be intensified.
   2. Contractor to schedule replacement work with the Owner's representative, and arrange for proper staging and access.

a. Contractor to include re-inspaection dats as part of replacment work scheduling.

3. The Contractor may relieve himself of theft responsibility if after the security notice, with no result, a written notice to the Landscape Architect shall be given that plant material will not be replaced for theft or vandalism due to lack of site security being maintained. This procedure may take place only during the Landscape Maintenance Period.

END OF SECTION

SECTION 331416
SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site water distribution system complete with valves, fire hydrants, and distribution pipelines from water supply mains to points of connection to the interior plumbing system of each building.

1.02 RELATED REQUIREMENTS

A. Project Geotechnical Report for excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

B. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2023.

C. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2020.

D. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

E. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 2019.

F. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

G. AWWA C504 - Rubber-Seated Butterfly Valves; 2023.

H. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1,200-mm) NPS; 2017.

I. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.

J. AWWA C800 - Underground Service Line Valves and Fittings; 2021.

K. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm); 2022.

L. UL 246 - Hydrants for Fire-Protection Service; Current Edition, Including All Revisions.

M. AWWA C651 Disinfecting Water Mains.

N. AWWA C110 Ductile-Iron and Gray-Iron Fittings

O. AWWA C153 Ductile-Iron Compact Fittings

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's catalog cuts for pipe, fittings, joint couplings; Backflow preventers and assemblies, fire hydrants; water meters and accessories; valves; and valve boxes.

1.05 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to the requirements indicated:
   1. Notify OWNER'S REPRESENTATIVE not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without OWNER'S REPRESENTATIVE written permission.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with utility company supplying water requirements.

B. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.

C. The Contractor shall have a copy of the Standard Specifications at the job site.

D. Piping materials shall bear label, stamp, or other markings of specified testing agency.

E. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installation, testing, flushing, and valve and hydrant supervision for fire service main piping for fire suppression.

G. NSF Compliance:
   1. Comply with NSF 14 for plastic potable-water-service piping.
   2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Do not store materials directly on the ground. Support the pipe uniformly during shipping and storage. Do not stack higher than 4 feet nor stack with weight on bells. Cover the pipe with plastic to protect it from sunlight. Keep inside of pipe and fittings free of dirt and debris. Avoid scratching the pipe surface.

B. Take special care to avoid damage to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged.

C. Prior to installation, each pipe length shall be carefully inspected for damage.

D. All pipe, fittings, and appurtenances shall be thoroughly cleaned before installation and shall be kept clean until installation and backfilling has completed.

E. Use only nylon ropes, slings, or other lifting devices that will not damage the surface of the pipe.

F. Keep the pipe clean and free of debris, dirt, animals, and trash during and after laying operations.

G. At the close of each operating day, seal the open end of the pipe using a gasketed night cap.

PART 2 PRODUCTS

2.01 WATER PIPE

A. PVC Pipe (NPS 1"-3"): ASTM D1785 Schedule 80.
   1. Fittings: ASTM D2467, PVC.
   2. Joints: ASTM D2855, solvent weld.

B. PVC Pipe (NPS 4"-12"): AWWA C900 Class 235:
   1. Ductile Iron Mechanical Joint Fittings: AWWA C110 Ductile Iron and Gray-Iron Fittings or AWWA C153 Ductile Iron Compact Fittings
   2. Gaskets: AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
   3. Joints: ASTM D3139 compression gasket ring.

C. Pipe for potable water use shall be blue, or dark grey in color. Pipe for recycled or reclaimed water use shall be purple in color.

D. Tracer Wire: #8 AWG Type UF (direct burial) stranded single conductor cable with high density polyethylene (HDPE) or high molecular weight polyethylene (HMWPE) insulation. The insulation shall be black in color.

E. Detectable Warning Tape: Install detectable warning tape during the installation of proposed utilities on contract drawings. Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 5 mils (0.1mm) thick, 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 (750 mm) deep, colored as follows:
   1. Blue: Potable water and fire protection service systems.
      a. Imprinted with "CAUTION BURIED WATER LINE BELOW" in large letters.
   2. Purple: Recycled/Reclaimed Water.
      a. Imprinted with "CAUTION BURIED RECLAIMED WATER LINE BELOW" in large letters.

2.02 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves 3 Inches and Over:
   1. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, ends, control rod, and extension box.

2.03 HYDRANTS

A. Hydrants: Type as required by utility company supplying water and fire department having jurisdiction.
   1. Before procurement, verify approval has been issued by the fire department having jurisdiction.

B. Finish: Primer and two coats of enamel in color required by utility company and fire department having jurisdiction.

2.04 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Project Geotechnical Report, and contract drawings.

B. Cover: As specified in Project Geotechnical Report, and contract drawings.

2.05 ACCESSORIES

A. Concrete for Thrust Restraints: As specified in the water purveyor supplying water standard specifications, or Standard Specifications for Public Works Construction; latest edition.

B. Meter: as required by water company.

2.06 CORROSION-PROTECTION ENCASEMENT FOR PIPING

A. Polyethylene Encasement for Underground Ductile-Iron Pipe and Fittings: Polyethylene encasement of eight mils thickness shall conform to AWWA C105. Joint tape shall be self sticking PVC or polythylene, eight mils thick.

B. Fusion-Bonded Epoxy Coatings for Ductile-Iron and Gray-Iron Fittings: Epoxy coating shall conform to AWWA C116.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to beginning work, verify that building service connection and municipal and site water main size, location, and invert are as indicated.

B. Examine trench bottom to ensure that it is accurately graded to provide uniform bearing and to support pipe.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. See the contract drawings for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide applicable square feet thrust restraint bearing on subsoil per contract drawing details and references.

D. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil, size as indicated.

E. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

A. Project site water lines shall terminate approximately five feet from buildings, unless otherwise indicated on Drawings. Install temporary cap or plug terminals for future connection to building.

B. Bury piping with depth of cover over top at least 36 inches, unless otherwise indicated.

C. Comply with NFPA 24 for fire-service-main piping materials and installation.

D. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use retrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports for all lines NPS 3 or greater.

E. Water Main Connection: Arrange and pay for tap in the water main, water meter, and all associated fees from the water purveyor.

F. Maintain separation of water main from sewer piping in accordance with applicable codes, jurisdicational requirements and the following:

1. Lay water mains over sanitary sewer lines to provide vertical separation a miminum of 12 inches.
    a. If 12 inch minimum separation cannot bet met:
        1) Install water line with all joints located at least 10 feet from each side of the sewer pipe.
        2) Encase sewer in 6 inches of concrete around pipe extended to 10 feet of either side of water pipe.

G. Install pipe to indicated elevation to within tolerance of 1/2 inches.

H. All pipe shall be laid true to line and grade as shown on the contract drawings.

I. Install pipe to allow for expansion and contraction without stressing pipe or joints.

J. Install tracer wire on top of pipe per contract drawing trenching detail. Tape tracer wire to pipe every 10 feet.
    1. Wire shall be continous strand. Crimpable copper butt splice kits are permitted in valve cans only. At valve cans, wire shall be routed up the outside of the valve riser, into the valve can at the top, 12-inch looped, and back down the outside of the valve riser.
    2. Wire shall terminate at surface in an in ground traffic rated access box labeled "Water".

3.05 INSTALLATION - VALVES, HYDRANTS, BACKFLOW PREVENTERS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with proposed finished grade.

C. Post Indicator Valve installation shall comply with NFPA 24. Include tamperproof electrical supervisory switch connected to fire alarm control panel.

D. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.

E. Set hydrants to grade, with nozzles at least above ground in accordance with Section .

F. Paint hydrants as required by the local fire authority or as indicated.

3.06 SERVICE CONNECTIONS

A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with bypass valves and sand strainer.

3.07 FIELD QUALITY CONTROL

A. See Section , for additional requirements.

B. Potable Water:
    1. Perform hydrostatic testing on private and public water piping as required by the local water purveyor supplying water.
    2. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

C. Fire Water:
    1. Perform flushing and hydrostatic testing in accordance with the applicable version of NFPA 24.

D. Perform Tracer Wire Continuity Tests.

E. Prepare reports of all testing activities.

3.08 CLEANING

A. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

B. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651.

END OF SECTION

SECTION 333113
SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, and accessories.

B. Connection of building sanitary drainage system to existing onsite sewer system.

1.02 RELATED REQUIREMENTS

A. Project Geotechnical Report.

1.03 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

A. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2020.

1.05 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to the requirements indicated:
   1. Notify OWNER'S REPRESENTATIVE not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without OWNER'S REPRESENTATIVE written permission.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories,and other sewer components as indicated.

C. Field Quality Control Submittals: Document results of field quality control testing.

D. Project Record Documents:
   1. Record location of pipe runs, connections, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with applicable code(s).

B. Plastic Pipe: ASTM D3034, SDR 35, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter as indicated, bell and spigot style rubber gasket joints.

C. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven [Mirafi] ;[140N]manufactured by[Mirafi].

B. Detectable Warning Tape: Install detectable warning tape during the installation of proposed utilities on contract drawings. Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 5 mils (0.1mm) thick, 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 (750 mm) deep, colored as follows:
   1. Green: Sewer drainage systems.
   2. Imprinted with "CAUTION BURIED SEWER LINE BELOW" in large letters.

2.03 **MANHOLE**

A. Lid and Frame: Cast iron construction.

2.04 BEDDING AND COVER MATERIALS

A. Bedding Material: As specified in Project Geotechnical Report, and contract drawings.

B. Cover Material: As specified in Project Geotechnical Report, and contract drawings.

PART 3 EXECUTION

3.01 GENERAL

A. Perform work in accordance with applicable code(s).

3.02 **EXAMINATION**

A. Prior to beginning work, verify that building service connections, municipal and site storm main size, location, and invert are as indicated.

3.03 TRENCHING

A. See Project Geotechnical Report for additional requirements.

B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Cut trenches wide enough to allow inspection of installed utilities.

F. Hand trim excavation for accurate placement of pipe to elevations indicated.

G. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

H. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume.

I. Remove excess excavated material and material that is unsuitable for re-use from site.

J. Stockpile excavated material to be re-used in area designated on site.

K. Provide temporary means and methods, as required, to remove all water from trenching. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

L. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

3.04 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building sanitary sewer outlet and municipal sewer system, through installed sleeves.

E. Install continuous detectable warning tape 12 inches above top of pipe.

3.05 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.06 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 014000.

B. Do not enclose, cover, or put into service before inspection and approval.

C. Tests: Upon completion of this portion of the work, and prior to accepatance by the owner, perform all required tests and secure approvals from agencies having jurisdiction.

D. Submit separate reports for each system inspection and test.

E. Defects requiring correction include the following:
   1. Alignment: Less than full diameter of inside of pipe is visible between structures.
   2. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   3. Infiltration: Water leaking into piping.
   4. Exfiltration: Water leakage from or around piping.
   5. Leaks and loss in test pressure constitute defects that must be repaired.

F. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

G. Reinspect and repeat procedure until results are satisfactory.

H. Gravity-Flow Sewer Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
   1. Option: Test according to requirements set forth in ASTM F 1417.

3.07 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 334211
STORMWATER GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gravity-flow, nonpressure site stormwater drainage piping.

B. Stormwater pipe accessories.

1.02 RELATED REQUIREMENTS

A. Project Geotechnical Report.

1.03 REFERENCE STANDARDS

A. AASHTO M 252 - Standard Specification for Corrugated Polyethylene Pipe, 75- to 250-mm (3- to 10-in.) Diameter; 2024.

B. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter; 2021.

C. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

D. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2020.

E. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2021.

F. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

G. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials; 2021.

H. Standard Specifications for Public Works Construction (Greenbook); current edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories, and other drain components as indicated.

C. Field Quality Control Submittals: Document results of field quality control testing.

D. Project Record Documents:
   1. Record location of pipe runs, connections, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to the requirements indicated:

1. Notify OWNER'S REPRESENTATIVE not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without OWNER'S REPRESENTATIVE written permission.

PART 2 PRODUCTS

2.01 **STORM DRAINAGE PIPE MATERIALS**

A. Plastic Pipe: ASTM D3034, Type PSM, SDR 35 Poly Vinyl Chloride (PVC) material; inside nominal diameter of 4-10 inches, bell and spigot style gasketed sealed joint ends.

B. Plastic Pipe: ASTM D3350, High Density Polyethylene (HDPE) corrugated wall pipe with integrally formed smooth liner; inside nominal diameter of 12-60 inch, meeting the requirements of AASHTO M 294, Type S, water-tight, bell and spigot joints with rubber gaskets, with pipe and fittings manufactured from virgin PE compounds with cell classification 3254420C.

C. Cast in Place Concrete: Greenbook Section 201-1.

2.02 PIPE ACCESSORIES

A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

B. Geotextile Fabric: Non-biodegradable, woven [Mirafi] ;[140N]manufactured by[Mirafi].

C. Detectable Warning Tape: Install detectable warning tape during the installation of proposed utilities on contract drawings. Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 5 mils (0.1mm) thick, 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 (750 mm) deep, colored as follows:
   1. Green: Storm drainage systems.
   2. Imprinted with "CAUTION BURIED STORM DRAIN LINE BELOW" in large letters.

2.03 BEDDING AND COVER MATERIALS

A. Bedding Material: As specified in Project Geotechnical Report, and contract drawings.

B. Cover Material: As specified in Project Geotechnical Report, and contract drawings.

PART 3 EXECUTION

3.01 **EXAMINATION**

A. Prior to beginning work, verify that building service connection and municipal and site utility water main size, location, and invert are as indicated.

3.02 TRENCHING

A. See Project Geotechnical Report for additional requirements.

B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Cut trenches wide enough to allow inspection of installed utilities.

F. Hand trim excavation for accurate placement of pipe to elevations indicated.

G. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

H. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume.

I. Remove excess excavated material and material that is unsuitable for re-use from site.

J. Stockpile excavated material to be re-used in area designated on site.

K. Provide temporary means and methods, as required, to remove all water from trenching. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

L. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

3.03 INSTALLATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building storm drainage system, foundation drainage system, and utility/municipal system.

E. Install continuous detectable warning tape 12 inches above top of pipe.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 014000 - Quality Requirements.

B. Do not enclose, cover, or put into service before inspection and approval.

C. Tests: Upon completion of this portion of the work, and prior to acceptance by the owner, perform all required tests and secure approvals from agencies having jurisdiction.
   1. Submit separate reports for each system inspection and test.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5% of internal piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leaking into piping.
      e. Exfiltration: Water leakage from or around piping.
      f. Leaks and loss in test pressure constitute defects that must be repaired.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.
   5. PVC Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Option: Test according to requirements set forth in ASTM F 1417.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION