Homewood Mountain Resort New Gondola

Homewood, CA

Specifications Manual

Divisions 01-32

Improvement Plan/Recreation Project Submittal June 16, 2023 DAO Project #: 2023-002



Mid-Mountain Terminal Perspective from the West

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DAO # 2023-002 cs2 # 23 2488 Issue for Construction

PROJECT ROSTER

PROJECT	HOMEWOOD MOUNTAIN RESORT NEW GONDOLA 5145 W. Lake Blvd. Homewood, California 96141
OWNER	JMA VENTURES LLC 5 Third Avenue, Suite 900 San Francisco, California ,94103 T: 530 412 0426
ARCHITECT:	DAOA-SVAM.INC. 7230 Meade Street Westminster, Colorado 80030 T: 720-273-0431
STRUCTURAL ENGINEER	SCJ ALLIANCE 45353 Manhattan Circle Suite 202 Boulder, Colorado 80303 T: 303-618-4555
ELECTRICAL ENGINEERS	CATOR RUMA & ASSOCIATES, 896 Tabor Street Lakewood, Colorado 80401 T: 303-580-5389
CIVIL/ ENVIRONMENTAL/ SURVEY/LANDSCAPE	PSOMAS 1075 Creekside Ridge Drive, Suite 200 Roseville, California 95678 T: 916-788 -4845
CONTRACTOR	LEVEL 10 CONSTRUCTION 1050 Enterprise Way Sunnyvale, California 94089 T: 408-747-5000
GEOTECHNICAL	NV5 10775 Pioneer Trail Suite 213 Truckee. California 96161
SPECIFICATIONS	CONSTRUCTION SPECIFICATION SPECIALISTS, LTD. 11972 W. Long Circle Unit 102 Littleton, Colorado 80127 T: 303-216-9560

DOCUMENT 000107

SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

- A. Architect:
 - 1. DANIEL ANTHONY ORECCHIO.
 - 2. ARC-401918.
 - 3. Responsible for Divisions 01-49 Sections except where indicated as prepared by other design professionals of record.
- B. Electrical Engineer:
 - 1. Craig Matthew Perry
 - 2. PE California E17600
 - 3. Responsible for Division 26

END OF DOCUMENT 000107

SECTION 011000

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Contractor's use of site and premises.
 - 4. Work restrictions.
 - 5. Specification and Drawing conventions.
 - 6. Miscellaneous provisions.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

Project Identification:	HOMEWOOD MOUTAIN RESORT NEW GONDOLA		
Project Location	514 W. Lake Blvd. Homewood, California 96141		
Owner .	JMA VENTURES LLC 5 Third Street Suite 900 San Francisco, California 94103 T: 415-728-0781		

Architect:

DAOA-SVAM.INC. 7230 Meade Street Westminster, Colorado 80030 T: 720-273-0431

- A. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.
 - 1. See Section 013100 "Project Management and Coordination." for requirements for using web-based Project software.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.
- C. PROJECT DISCRIPTION
 - 1. Work for this project entails the construction of a new gondola line for the Homewood Mountain Resort in Homewood California.
 - 2. A new base and upper terminal will be installed (by doppelmayr) with a new terminal platform constructed around each terminal featuring stone filled gabion walls, pavers, a concrete pit and pit walls, galvanized guardrails and railings.
 - 3. A terminal plaza will be constructed around the new gondola terminal. The terminal plaza will consist of cast-in-place concrete foundation walls and concrete slab on grade for the maintenance pit area, gabion retaining walls to be filled with natural fill from the site.
 - 4. The terminal will be located approximately 12 feet above adjacent grade, as such, a cast in place concrete stair will be provided to access the terminal plaza. The gabion retaining wall will extend 42" above the plaza level to act as guard fall protection and a removeable metal guardrail will be installed that will act as ski access during the winter season. The removable guardrail and the railings for the stairs will be comprised of galvanized metal.
 - 5. New terminal shacks will be furnished and installed by others and new siding will be provided and installed as specified.

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.7 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. Smoking and Controlled Substance Restrictions: Use of tobacco products , alcoholic beverages, and other controlled substances on Project site is not permitted.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 - 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit electronic PDF documentation of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form acceptable to Owner and Architect..
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors; that will be necessary to accommodate proposed substitution.

- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- e. Samples, where applicable or requested.
- f. Certificates and qualification data, where applicable or requested.
- g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
- h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project,
- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- I. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven calendar days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 14 calendar days of receipt of request, or seven calendar days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 14 calendar days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity

duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Division 01 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

- 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- 1.3 DEFINITIONS
 - A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

- 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
- 2. Arrange schedule of values consistent with format of AIA Document G703.
- 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
- 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
- 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
- 7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

- 9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- 1.5 APPLICATIONS FOR PAYMENT
 - A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
 - B. REFER TO OWNER PROVIDED CONTRACT; AGREEMENT FOR CONSTRUCTION SERVICES FOR PAYMENT PROCEDURES.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project Web site.
 - 5. Project meetings.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

1.6 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 electronically.
 - 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. RFI Forms: Contractor shall submit electronic RFI format for approval .
 - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow five working days for Architect's response for each RFI. RFIs received by Architect 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 Division 01 Section "Contract Modification Procedures."
- E. 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.
- F. 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.
 - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 - 1. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
 - 1. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
 - 3. Two paper copies.
- B. Startup construction schedule.
 - 1. Submit a Construction schedule indicating the work and submittal activities occurring within the first 90 days from notice to proceed.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.

- F. Daily Construction Reports: Submit at weekly intervals.
- G. Material Location Reports: Submit at weekly intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Special Reports: Submit at time of unusual event.

1.4 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Ganttchart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.2 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.

- 5. Material deliveries.
- 6. High and low temperatures and general weather conditions, including presence of rain or snow.
- 7. Accidents.
- 8. Meetings and significant decisions.
- 9. Unusual events (see special reports).
- 10. Stoppages, delays, shortages, and losses.
- 11. Meter readings and similar recordings.
- 12. Emergency procedures.
- 13. Orders and requests of authorities having jurisdiction.
- 14. Change Orders received and implemented.
- 15. Work Change Directives received and implemented.
- 16. Services connected and disconnected.
- 17. Equipment or system tests and startups.
- 18. Partial completions and occupancies.
- 19. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
 - 1. Material stored prior to previous report and remaining in storage.
 - 2. Material stored prior to previous report and since removed from storage and installed.
 - 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

- 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

- 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
- 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
- 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
- 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: 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.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
- 1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
- 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
- 3. Resubmittal Review: Allow 10 days for review of each resubmittal.
- 4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 10 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 - 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 - 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - I. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.

- r. Remarks.
- 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- E. Options: Identify options requiring selection by Architect.
- F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
 - 2. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
 - 3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

- b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before or concurrent with Samples.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.

- 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit four full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - 2. Manufacturer and product name, and model number if applicable.
 - 3. Number and name of room or space.
 - 4. Location within room or space.
 - 5. Submit product schedule in the following format:

- a. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.
- E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports

on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
 - 1. No exceptions taken
 - 2. Make corrections noted
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 33 00

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. 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.
- B. 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. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and

to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

- 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- 2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
- 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting

requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data : For Contractor's quality-control personnel.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.

- 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
- 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
- 12. Name and signature of laboratory inspector.
- 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. 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.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.8 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

- 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
- 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
- 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
- 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
- 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
- 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- C. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.

- 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
- 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required qualityassurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- 1.9 SPECIAL TESTS AND INSPECTIONS
 - A. Special Tests and Inspections: Contractor shall engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Contractor , and as follows:
 - 1. Submitting a certified written report of each test, inspection, and similar qualitycontrol service to Architect with copy to Contractor and to authorities having jurisdiction.
 - 2. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

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SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 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. "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.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "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.

1.3 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.
- 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.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.
- 1.5 PRODUCTS (Not Used)

PART 2 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERALGENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

- A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.5 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.6 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack board.
 - 3. Drinking water and private toilet.
 - 4. Coffee machine and supplies.
 - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service overhead, unless otherwise indicated.

- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - 2. Install lighting for Project identification sign.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - e. Engineers' offices.
 - f. Owner's office.
 - g. Principal subcontractors' field and home offices.
 - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in common-use facilities.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
 - 2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.

- C. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
 - 1. Provide temporary, directional signs for construction personnel and visitors.
 - 2. Maintain and touchup signs so they are legible at all times.
- D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Division 1 Section "Summary."
- B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- E. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent

construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION 01 50 00

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.3 DEFINITIONS

- A. 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 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.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. 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.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

- 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.
 - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- 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 Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- 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.
 - 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - 5. Basis-of-Design Product: 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. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

- C. 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 Division 01 Section "Substitution Procedures" for proposal of product.
- D. 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.

2.2 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

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SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- PART 2 PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
- C. Record Log: Maintain a log of layout control work. Insert special requirements for laying out the Work to suit Project.

3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.

- 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- 4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
 - 1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

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END OF SECTION 01 73 00

SECTION 017329

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
 - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 1. Primary operational systems and equipment.
 - 2. Air or smoke barriers.
 - 3. Fire-protection systems.
 - 4. Control systems.
 - 5. Communication systems.
 - 6. Conveying systems.
 - 7. Electrical wiring systems.
 - 8. Operating systems of special construction in Division 13 Sections.
- C. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- D. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.
- 2.2 REPAIR MATERIALS
- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm).
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5700 psi (39 MPa) at 28 days when tested according to ASTM C 109/C 109M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

- a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
- 4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

END OF SECTION 017329

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SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit sustainable design submittals required in Division 01 sustainable design requirements Section and in individual Division 02 through 33 Sections.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."

- 6. Advise Owner of changeover in heat and other utilities.
- 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
- 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
- 9. Complete final cleaning requirements, including touchup painting.
- 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.("Architects Punch List") Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued..("Architects Punch List")
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
 - 1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 - 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.("Architects Punch List") Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.("Architects Punch List")
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST) CONTRACTORS

- A. Organization of List: 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.
 - 1. Organize list of spaces in sequential order.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 - 4. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

- 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
- 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
- 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

- a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
- b. Enable inserted reviewer comments on draft submittals.
- 2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

- 2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS
 - A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
 - B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
 - C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
 - D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
 - E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use PDF electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks

reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

- F. Manuals, Paper Copy: (In addition to electronic files) Submit manuals in the form of hard copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 - 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 - 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 - 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

- 1. Fire.
- 2. Flood.
- 3. Gas leak.
- 4. Water leak.
- 5. Power failure.
- 6. Water outage.
- 7. System, subsystem, or equipment failure.
- 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.

- 8. Engineering data and tests.
- 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.

- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

- 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

- 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."
- G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

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SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit *one* paper-copy set of marked-up record prints.
 - Submit PDF electronic files of scanned record prints and one of file prints.
 - 3) Submit record digital data files and one set(s) of plots.
 - 4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit *three* paper-copy set(s) of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and *three* set(s) of prints.
 - 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit *one* paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit *one* paper copy and annotated PDF electronic files and directories of each submittal.

- 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Work Change Directive.
 - k. Changes made following Architect's written orders.
 - I. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.

- 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
- 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 - 1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 - 2. Format: DWG, Version , Microsoft Windows operating system.
 - 3. Format: Annotated PDF electronic file with comment function enabled.
 - 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - 5. Refer instances of uncertainty to Architect for resolution.
 - 6. Architect will not furnish Contractor a set of digital data files of the Contract Drawings for use in recording information.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 - 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 - 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file with comment function enabled.
 - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 - 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 - 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

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SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training

1.3 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. At completion of training, submit one complete training manual(s) for Owner's use.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
- E. Demonstration and Training : Submit two copies within seven Insert number days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.

- b. Name and address of photographer.
- c. Name of Architect.
- d. Name of Contractor.
- e. Date videotape was recorded.
- f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- 2. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavyduty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
 - 1. Motorized doors, including automatic entrance doors.
 - 2. Equipment, including food-service equipment.
 - 3. Fire-protection systems, including fire alarm and fire-extinguishing systems.
 - 4. Intrusion detection systems.
 - 5. Conveying systems, including elevators.
 - 6. Heat generation, including boilers feedwater equipment pumps steam distribution piping and water distribution piping.
 - 7. Refrigeration systems, including chillers cooling towers condensers pumps and distribution piping.
 - 8. HVAC systems, including air-handling equipment air distribution systems and terminal equipment and devices.
 - 9. HVAC instrumentation and controls.
 - 10. Electrical service and distribution, including transformers switchboards panelboards uninterruptible power supplies and motor controls.
 - 11. Lighting equipment and controls.
 - 12. Communication systems, including intercommunication surveillance clocks and programming voice and data and television equipment.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.

- e. Identification systems.
- f. Warranties and bonds.
- g. Maintenance service agreements and similar continuing commitments.
- 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
- 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - I. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.

- g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING

- A. General: Engage a qualified commercial photographer to record demonstration and training . Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Transcript: Provide a typewritten transcript of the narration.

END OF SECTION 01 79 00

SECTION 024100 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

- A. Section 011000 Summary: Limitations on Contractor's use of site and premises.
- B. Section 011000 Summary: Description of items to be removed by Owner.
- C. Section 011000 Summary: Description of items to be salvaged or removed for re-use by Contractor.
- D. Section 015000 Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- E. Section 016000 Product Requirements: Handling and storage of items removed for salvage and relocation.
- F. Section 017000 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.
- G. Section 312323 Fill: Filling holes, pits, and excavations generated as a result of removal operations.

1.03 DEFINITIONS

- A. Demolition: 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).

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

- A. Remove paving and curbs required to accomplish new work.
- B. Remove all other paving and curbs within site boundaries.
- C. Remove concrete slabs on grade within site boundaries.
- D. Remove fences and gates.
- E. Remove other items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. 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.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until vegetation to be relocated has been removed and vegetation to remain has been protected from damage.
- D. 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.
- E. Hazardous Materials:
 - 1. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.
- 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 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
 - 5. Concrete toppings.
 - 6. Building frame members.
 - 7. Building walls.
- B. Related Sections:
 - 1. Section 033300 "Architectural Concrete" for general building applications of specialty finished formed concrete.
 - 2. Section 321313 "Concrete Paving" for concrete pavement and walks.
 - 3. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, slag, and silica fume; subject to compliance with requirements.
- 1.4 ACTION SUBMITTALS
 - A. Product Data: For each type of product indicated.
 - B. Design Mixtures: For each concrete mixture. Submit design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

- 2. The maximum amount of water which can be added at the project site.
- 3. The allowable slump range for each mixture.
- 4. Provide sample breaking strengths for each proposed design mix.
- C. 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.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- F. Samples: For vapor retarder.
 - 1. Vapor Barrier Minimum 15 mil vapor barrier such as Stego Wrap or approved alternative.
- 1.5 INFORMATIONAL SUBMITTALS
 - A. Qualification Data: For Installer, manufacturer, and testing agency.
 - B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Curing compounds.
 - 7. Floor and slab treatments.
 - 8. Bonding agents.
 - 9. Adhesives.
 - 10. Vapor retarders.
 - 11. Joint-filler strips.
 - C. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Concrete air ratio
 - 2. Concrete slump
 - 3. 28 & 56 day concrete strength/compression tests typical of design mix.
 - D. As-built survey illustrating appropriate water flow per the design documents.
E. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. 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."
 - 2. Where Self Consolidating Concrete is used, the Ready Mix Producer shall have a Quality Control Representative on site during placements until mix consistency and stability is established.
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 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.
- D. 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.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Mockups: Cast concrete **slab-on-grade** panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 - 1. Build panel approximately 200 sq. ft. (18.6 sq. m) as directed by Architect.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Assure that no oils, mud, form release or rust scale contaminates the surface of the reinforcing.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- C. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

- 2.2 STEEL REINFORCEMENT
 - Α.
 - B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
 - C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
 - D. Plain-Steel Wire: ASTM A 82/A 82M,
 - E. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Corporation; Sika Greenstreak two component Speed Dowel System
 - System Components: Reusable base and plastic sleeve.
 a. Material: Polypropylene plastic.
 - 3. Size: To accept slip dowels of the following dimensions:
 - a. Diameter: 5/8"ength: As drawn<Insert dimension>.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 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 I Supplement with the following:**
 - a. Fly Ash: ASTM C 618, **Class F**.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S or Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C.

D. Water: ASTM C 94/C 94M and potable. Conforming to requirements of ASTM C1602.

2.5 ADMIXTURES

- A. Chemical Admixtures: Provide admixtures from a single manufacturer and certified by manufacturer to be compatible each other.
 - 1. Air-Entraining Admixture: per ASTM C 260.
 - 2. Water-Reducing Admixture: per ASTM C 494/C 494M, Type A.
 - 3. Mid-Range Water-Reducing Admixture: per ASTM C 494/C 494M, Type A and F.
 - 4. High-Range, Water-Reducing Admixture: per ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Workability Enhancing Admixtures: per ASTM C 494/C 494M, Type S.
 - 7. Set Retarding and Hydration Stabilizers: per ASTM C 494/C 494M, Type B and D.
 - 8. Set-Accelerating Admixtures:
 - a. Non-Chloride Based Accelerator, per ASTM C 494/C 494M Type C or C and E:
 - b. Non-Chloride Based Hardening Accelerator. ASTM C 494/C 494M Type C:
 - 9. Viscosity Modifying Admixtures: ASTM C 494/C 494M, Type S:
- B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored waterreducing admixtures; color stable, **free of carbon black**, nonfading, and resistant to lime and other alkalis.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Scofield, L.M. Scofield Company.
 - b. Butterfield Color
 - 2. Color: As selected by Architect from manufacturer's full range.

2.6 FINISHING AIDS AND SURFACE TREATMENTS

A. Finishing Aid.

1. Basis-of-Design Product: Subject to conformance with requirements, provide Sika Corporation; SikaFilm or comparable product by one of the following:

2.7 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: [Monofilament] [or] [fibrillated] polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, [1 to 2-1/4 inches (25 to 57 mm)] long.

2.8 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, 15 mill, Class A >]. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Corporation; SikaProof A or comparable product by one of the following:
 - a. Stego Industries, LLC.
 - b.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Sika Corporation; SikaFilm or comparable product by one of the following:
- B. Water: Potable.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: **ASTM D 1751**, asphalt-saturated cellulosic fiber].

2.11 REPAIR MATERIALS

A. Any necessary repair materials shall be proposed by the contractor and approved by the Architect, Engineer, and Owner.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials:
- C. Limit water-soluble, chloride-ion content in hardened concrete to [0.06] [0.15] [0.30] [1.00] percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. 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.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Color Pigment: The concrete mix should be appropriate to provide the specified color enhancements. The mix design should consider any admixtures which may affect the color. Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and foundation walls: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4500 psi (31 MPa) at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - Slump Limit: [4 inches (100 mm)] [5 inches (125 mm)] [8 inches (200 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] <Insert dimension>, plus or minus 1 inch (25 mm).
 - 4.
- a. Resistance to Segregation: Achieve a maximum static segregation percentage of 15% when tested according to ASTM C 1610 with a VSI index of 2 1 maximum.
- b. Passing Ability: ASTM C 1621 with a maximum difference of 2" (50mm) between testing with and without the J-Ring.
- 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: **4500 psi (31 MPa)** at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Slump Limit: Listed with the approved mix design.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
 - 6. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than **4.0 lb/cu. yd. (2.4 kg/cu. m**.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 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.

PART 3 - EXECUTION

3.1 FORMWORK

- A. 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.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where 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.

- F. 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.
- G. 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.
- H. **Chamfer**exterior corners and edges of permanently exposed concrete walls and foundations.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 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 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."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, 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 (10 deg C) for 24 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. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved **at least 70 percent of** its 28-day design compressive strength.

- 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. 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.

3.4 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. 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.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

- B. Construction 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. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least **one-fourth**of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, 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.
 - Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "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.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water more water than allowed by the delivery ticket to concrete during delivery, at Project site, or during placement unless approved by Construction Engineer.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- 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. If a section cannot be placed continuously, provide construction joints as indicated. 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. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301. Where Self Consolidating Concrete is used, limit and/or avoid vibration to prevent mix segregation.
- 3. 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 (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. 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.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Where Self Consolidating Concrete is used, limit and/or avoid vibration to prevent mix segregation.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Slope surfaces uniformly to drains where required.
 - 6. Begin initial floating using bull floats or darbies to form a uniform and opentextured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. 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 (4.4 deg C) within three days of the start of the end of the concrete pour, 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 or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 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 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.

3.8 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-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 defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces **exposed to public view including the pit retaining wall**.
- B. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: Not used
- C. Float Finish: Not used
- D. Trowel Finish: After applying float finish, apply first troweling 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.
 - 1. Apply a trowel finish to surfaces [**exposed to view**]
 - Except where slopes change within the slab, finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-(3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, walkways, ramps, and elsewhere as indicated.

1. Immediately after float finishing, roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases **4 inches ((100 mm** high unless otherwise indicated; and extend base not less than **6 inches (150 mm)** in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: **4500 psi (31 MPa** at 28 days.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.11 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 ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m 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.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist

cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 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 (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moistureretaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moistureretaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3.12 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment 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 **seven** days' old.
 - 3. 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.

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3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least **six** month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semi rigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. The contractor shall submit an RFI with proposed repair products and procedures which shall be approved by the Owner, Architect, and Engineer.

3.15 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.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. 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.

- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 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.
 - 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.
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 - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; [ASTM C 173/C 173M, volumetric method, for structural lightweight concrete;]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 (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - 7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratorycured 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 one set of two specimens at 28 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.
 - 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 (3.4 MPa).
 - 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. 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.

- 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within **48** hours of finishing.

END OF SECTION 033000

SECTION 05 50 00.22

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section Includes:
 - 1. Metal bollards.
 - 2. Abrasive Stair Nosing.
 - 3. Detectable Warnings

1.3 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 MATERIALS

- A. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- B. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

2.3 FABRICATION, GENERAL

- 2.4 METAL BOLLARDS
 - A. Fabricate metal bollards from Schedule 40 steel pipe 1/4-inch (6.4-mm) wall-thickness steel tubing.
 - 1. Cap bollards with 1/4-inch- (6.4-mm-) thick, steel plate with domed top.
 - B. Fabricate bollards with 3/8-inch- (9.5-mm-) thick, steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch (19-mm) anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
 - C. Fabricate sleeves for bollard anchorage from stainless steel pipe or tubing with 1/4inch- (6.4-mm-) thick, stainless-steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.

2.5 ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Cast-Metal Units: Cast aluminum, with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Safety Tread Co., Inc.
 - b. Balco; a CSW Industrials Company.
 - c. Wooster Products Inc.
 - 2. Source Limitations: Obtain units from single source from single manufacturer.
 - 3. Cross-hatched nosing's, 4 inches (100 mm) wide, with 1/4-inch- (6-mm-) thick 1- inch (25-mm) lip, for casting into concrete.
 - 4. Color: Yellow.

2.6 DETECTABLE WARNINGS

- A. Manufacturer: Vanguard ADA Systems
- B. Composition: Fluid applied Comprised of resins, reactive monomers, pigments, glass beads, and fillers. Non skid surface.
- C. Seal coat. Manufacturers standard.
- D. Width and length : As detailed. With truncated Domes.
- E. Color: Yellow.

2.7 STEEL AND IRON FINISHES

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
 - A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
 - B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

END OF SECTION 05 50 00.22

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SECTION 05 52 13.13

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel tube, railings, metal guard rails and Teak wood cap insert.
 - 2. Stair nosing's and detectable warning devices (Refer to Section 055000

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, and patio decks including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings shall 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.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. 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..
 - b. Infill load and other loads need not be assumed to act concurrently.

- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. 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.

PART 2 - PRODUCTS

- 2.1 METALS, GENERAL
 - A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
 - B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.2 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.3 FASTENERS

- A. Fasteners for Anchoring Railings 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.
- B. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

- 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
- 3. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welding.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Provide Teak wood cap insert for railing. Refer to details.

2.5 FABRICATION

- A. General: 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. 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.
- D. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- F. Connections: Fabricate railings with welded connections unless otherwise indicated.
- G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
- H. Form changes in direction as follows:
 - 1. As detailed.
- I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

- J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- L. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- 2.6 STEEL PIPE RAILINGS
 - A. Refer to details for design of stair railings.
- 2.7 FINISHES, GENERAL
 - A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 2.8 STEEL AND IRON FINISHES
 - A. Galvanized Railings:
 - 1. Hot dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 - B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
 - C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
 - A. Fit exposed connections together to form tight, hairline joints.

- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

- A. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- B. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 05 52 13,13

SECTION 07 46 00 .22

SIDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid exterior board siding.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Verification: For each type, color, texture, and pattern required.
 - 1. 12-inch- long-by-actual-width Sample of siding.
 - 2. 24-inch- wide-by-36-inch- high Sample panel of siding assembled on plywood backing.
 - 3. 12-inch- long-by-actual-width Samples of trim and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified vinyl siding Installer.
- B. Product Certificates: For each type of siding, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.
- D. Research/Evaluation Reports: For each type of siding required, from the ICC.
- E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of siding and soffit and related accessories to be included in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Labeling: Provide siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for siding including accessories.
 - a. Size: 48 inches long by 60 inches high.
 - b. Include outside corner on one end of mockup and inside corner on another end.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site.
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Store materials in a dry, well-ventilated, weathertight place.

1.8 COORDINATION

- A. Coordinate installation with flashings and other adjoining constructions to ensure proper sequencing.
- 1.9 WARRANTY
 - A. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding, that fail(s) in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking, deforming, and fading.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

- 2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 5 Hunter color-difference units as measured according to ASTM D 2244.
- 3. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 SOLID SIDING
 - A. Manufacturer: Moso
 - B. Material: Moso Bamboo X-treme solid, thermos-Density exterior board, made from compressed bamboo strips. A special, thermal modification process at 392 degrees F provides and increases the stability and density, and hardness.
 - 1. Complies with Class A (ASTM E84
 - 2. Profile Shiplap and smooth surface.
 - 3. Size: 1x8x6x3/4inch.
 - C. Fasteners: As per manufacturer.
 - D. Accessories: As per manufacturer. Metal flashing and trim as shown on Drawings.
 - E. Sealant: Sealant as recommended by board manufacturer for vertical joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding, and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with siding manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace them with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 00.22

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3. and the following applications:
 - 1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - e. Other joints as indicated.
 - 2. Joints in the following horizontal traffic surfaces:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long

strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- E. Qualification Data: For Installer.
- F. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- H. Field Test Report Log: For each elastomeric sealant application.
- I. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- J. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT 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 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
 - 1. REFER TO END OF SECTION FOR JOINT SCHEDULE

2.2 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. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 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.
- 2.4 LATEX JOINT SEALANTS
 - A. Latex Sealant: LS Comply with ASTM C 834, Type P, Grade NF.
 - B. Available Products:
 - 1. Bostik Findley; Chem-Calk 600.
 - 2. Pecora Corporation; AC-20+.
 - 3. Schnee-Morehead, Inc.; SM 8200.
 - 4. Sonneborn, Division of ChemRex Inc.; Sonolac.
 - 5. Tremco; Tremflex 834.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type 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.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) O (open-cell material) B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
 - a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 - 2. Remove laitance and form-release agents from concrete.
 - a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, 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.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings 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 sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. 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 in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

- 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 JOINT SEALANT SCHEDULE

- A. LS Latex Sealants
 - 1. Interior joints in field painted vertical and overhead surfaces at perimeter of elevator door frames and hollow metal door frames, in gypsum drywall, veneer plaster, concrete and concrete masonry and all other interior joints not indicated otherwise.

END OF SECTION 07 92 00

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SECTION 099113

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel pipe bollards.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.

1.4 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide <u>Sherwin-Williams Company (The)</u>; products indicated or comparable product from one of the following:

- 1. Benjamin Moore Corporation.
- 2. PPG Architectural Finishes, Inc.
- 3. The Sherwin-Williams Company.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-site testing to verify compatibility, adhesion, and film integrity of new paint application.
 - 1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "Data Pages" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- C. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.

- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- 3.4 EXTERIOR PAINTING SCHEDULE
 - A. Ferrous Metal Substrates:
 - 1. Water-Based Light Industrial Coating System: Prime Coat: Manufactures Recommended Primer..
 - a. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - Topcoat: Water-based acrylic, semi-gloss Gloss Level 5: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series. BM Super Spec HP DTM Semi-Gloss, P29 Series PPG Pitt-Tech Plus Interior/Exterior Semi-Gloss, 99-1210.

END OF SECTION 099113

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SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL:

- 1.1 RELATED DOCUMENTS:
 - A. All drawings associated with the entire project, including general provisions of the Contract, including The General Conditions of the Contract for Construction, General and Supplementary Conditions and Division-1 Conditions specification sections shall apply to the Division 26 specifications and drawings. The Contractor shall be responsible for reviewing and becoming familiar with the aforementioned and all other Contract Documents associated with the project.
 - B. Where contradictions occur between this section and Division 1, the more stringent requirement shall apply.
 - C. Contractor shall be defined as any and all entities involved with the construction of the project.

1.2 SUMMARY:

- A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26 and Division 28. It expands and supplements the requirements specified in sections of Division 1 through 50.
- 1.3 ELECTRICAL INSTALLATIONS:
 - A. Drawings are diagrammatic in character and do not necessarily indicate every required conduit, box, fitting, etc.
 - B. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both. Report any discrepancies to the Engineer and obtain written instructions before proceeding. Where any contradictions occur between the specifications and the drawings the more stringent requirement shall apply. The contractor shall include pricing for the more stringent and expensive requirements.
 - C. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or must be made from field measurement, take the necessary measurements and prepare the drawings.
 - D. The exact location for some items in this specification may not be shown on the drawings. The location of such items may be established by the Engineer during the progress of the work.
 - E. The contractor shall make the installation in such a manner as to conform to the structure, avoid obstructions, preserve headroom, and keep openings and passageways clear, without further instructions or costs to the Owner. All equipment shall be installed so access is maintained for serviceability.
 - F. Before any work is begun, determine that equipment will properly fit the space and that conduit can be run as contemplated without interferences between systems, with structural elements or with the work of other trades.
 - G. Verify all dimensions by field measurements.
 - H. Arrange for chases, slots, and openings in other building components to accommodate electrical installations.

- I. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring an access path for positioning prior to closing-in the building or space.
- J. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components as much as practical and connect equipment for ease of disconnecting and removal with minimum of interference with other installations.
- K. Make allowance for expansion and contraction for all building electrical components and conduit systems that are subject to such.
- L. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- 1.4 COORDINATION WITH OTHER DIVISIONS:
 - A. General:
 - 1. Coordinate all work to conform to the progress of the work of other trades.
 - Complete the entire installation as soon as the condition of the building will permit. No extras will be allowed for corrections of ill-timed work when such corrections are required for proper installation of other work.
 - B. Chases, Inserts and Openings:
 - 1. Provide measurements, drawings, and layouts so that openings, inserts, and chases in new construction can be built in as construction progresses.
 - 2. Check sizes and locations of openings provided, including the access panels for equipment in hard lid ceilings and wall cavities.
 - 3. Any cutting and patching made necessary by failure to provide measurements, drawings and layouts at the proper time shall be done at no additional cost in contract sum.
 - C. Support Dimensions: Provide dimensions and drawings so that concrete bases and other equipment supports to be provided under other sections of the specifications can be built at the proper time.
 - D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
 - E. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
 - F. Modifications required as result of failure to resolve interferences, provide correct coordination drawings or call attentions to changes required in other work as result of modifications shall be paid for by responsible Contractor/Subcontractor.
- 1.5 DESIGN WORK REQUIRED BY CONTRACTOR:
 - A. The construction of this project requires the Contractor to include the detailing and design of several systems and/or subsystems. All such design work associated with the development of the coordination drawings shall be the complete responsibility of the Contractor.
 - B. The Contractor shall take the full responsibility to develop and complete routing strategies which will allow fully coordinated system to be installed in a fully functional manner. The Engineers contract drawings shall be for system design intent and general configurations.

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- C. Systems or subsystems which require design responsibility by the contractor include but are not limited to:
 - 1. Temporary Facilities.
 - 2. Utility Company Coordination details.
 - 3. Final coordinated distribution systems.
 - 4. Any system not fully detailed.
 - 5. Equipment supports, hangers, anchors, and seismic systems not fully detailed nor specified in these documents or catalogued by the manufacturer.
 - 6. Seismic restraint systems.
- 1.6 **PROJECT CONDITIONS**:
 - A. The contractor shall be required to attend a pre-bid walk-thru if required and shall make themselves familiar with the existing conditions. No additional costs to the Owner shall be accepted for additional work for existing conditions.
 - B. Field verify all conditions prior to submitting bids.
 - C. Report any damaged equipment or systems to the Owner prior to any work.
 - D. Protect all work against theft, injury, or damage from all causes until it has been tested and accepted.
 - E. Be responsible for all damage to the property of the Owner or to the work of other contractors during the construction and guarantee period. Repair or replace any part of the work which may show defect during one year from the final acceptance of all work, provided such defect is, in the opinion of the Architect, due to imperfect material or workmanship and not due to the Owner's carelessness or improper use.
 - F. The Contractor shall coordinate and cooperate with Owner at all times for all new to existing connections.
 - G. Provide temporary electrical connections where required to maintain existing areas operable.
 - H. Coordinate all services shutdown with the Owner; provide temporary services. Coordinate any required disruptions with Owner, at a minimum one week in advance.
 - I. Minimize disruptions to operation of electrical systems in occupied areas.
- 1.7 SAFETY:
 - A. Refer to Division 1.
- 1.8 EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS:
 - A. Refer to Division 1 and conform with the Owners requirements.
- 1.9 REQUIREMENTS OF REGULATORY AGENCIES:
 - A. Refer to Division 1.
 - B. Execute and inspect all work in accordance with Underwriters Laboratories (UL), and all local and state codes, rules, and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the more stringent requirement shall be followed. Follow application sections and requirements and testing procedures of NFPA, IEEE, NEMA, CBM, ANSI, NECA, ICEA, NETA, and IETA.

- C. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.
- D. Energy Codes: All equipment and installations shall conform to Federal, State, and local Energy Conservation Standards.
- E. The handling, removal and disposal of regulated liquids or other materials shall be in accordance with U.S. EPA, state, and local regulations.
- F. The handling, removal and disposal of lead-based paint and other lead containing materials shall comply with EPA, OSHA, and any other Federal, State, or local regulations.
- G. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.
- H. All material used on this project shall be UL listed and labeled and be acceptable to the authority having jurisdiction as suitable for the use intended.

1.10 REQUIREMENTS OF LOCAL UTILITY COMPANIES:

- A. Comply with rules and regulations of local utility companies. Include in bid the cost of all meter boxes, meters and such accessory equipment which will be required but not provided by Local Utility Company for the project.
- B. Utility Connections:
 - 1. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
 - 2. The contract documents indicate the available information on existing utilities and services and on new services (if any) to be provided to the project by utility companies and agencies. Notify Engineer immediately if discrepancies are found.
 - 3. Coordinate electrical utility interruptions at least one week in advance as approved in writing with the Owner and the utility company. Plan work so that duration of the interruption is kept to a minimum.
 - 4. Nominal system voltages have been identified on the contract documents. Coordinate and install relay settings, circuit breaker settings, generator output settings, transformer taps, etc. with measured utility voltage obtained from the Utility. Identify phase rotation and other parameters with shop drawings for service entrance equipment submittals.
 - 5. Provide utility company approved equipment and install all CT enclosures/bus, conduit and wiring, meter sockets, connection cabinets, etc. as required by serving Utility. Locate final meter location in conjunction with the utility representative and coordinate with Architect/Engineer.
 - 6. Make all applications for service including temporary services for construction and coordinate service requirements. Arrange and pay for all utility fees and costs of electricity until final services are transferred to owner.
 - 7. Document final phase rotation, voltages on each phase, neutral and ground currents and voltages once serving utility services are connected at service entrance location. Adjust tap, relay, and other settings as necessary for delivered utility electric services. Submit final configurations and values with Testing and Equipment Settings Report.

1.11 PERMITS AND FEES:

- A. Refer to Division 1.
- B. Owner shall pay all fees required for connection to municipal and public utility facilities.

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- C. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.
- 1.12 PROJECT SEISMIC REQUIREMENTS:
 - A. Installation shall comply with the local seismic requirements for the area of installation. Provide restraints, bracing, anchors, vibration isolation, seismic snubbers, and all other components required for the installation.
 - B. All electrical systems shall be installed to meet NFPA and IBC Seismic requirements.
 - 1. Where any conflicts arise the more stringent requirements shall be applicable.
 - 2. The design of the seismic restraints shall be the responsibility of the contractor.

1.13 TEMPORARY FACILITIES:

- A. Light, Heat, Power, Etc. Responsibility for providing temporary electricity, heat and other facilities shall be as identified in these specifications, as shown on the drawings and as specified in Division 1.
- 1.14 PRODUCT OPTIONS AND SUBSTITUTIONS:
 - A. Refer to the Instructions to Bidders and Division 1.
 - B. The burden of proof that proposed equipment is equal in size, capacity, performance, and other pertinent criteria for this specific installation, or superior to that specified is up to the Contractor. If substitutions are not granted, the specified materials and equipment must be installed. Where substituted equipment is allowed, it shall be the Contractor's responsibility to notify all related trades of the accepted substitution and to assume full responsibility for all costs caused as a result of the substitution.
 - C. Materials and equipment of equivalent quality shall be submitted for substitution prior to bidding. This may be done by submitting to the Architect/Engineer at least ten (10) working days prior to the bid date requesting prior review. This submittal shall include all data necessary for complete evaluation of the product.
 - 1. Substitutions shall only be allowed upon the written approval of the Architect/Engineer
 - 2. The Contractor shall be responsible for removal, replacement and remedy of any system or equipment which has been installed which does not meet the specifications and scheduled performance or which does not have prior approval.
 - D. Bidders opting to bid or propose comparable products (either a product by a listed acceptable manufacturer in the respective specification section or a substitution request) are responsible for:
 - 1. Confirming the proposed equipment will fit in the space available, including the equipment's clearance requirements.
 - 2. Coordination of any variance from basis-of-design in weight, electrical requirements, other utility requirements, etc. with other trades.
 - 3. Inclusion in the bid of any applicable costs for changes in prime bidder's and their sub bidders' work required to accommodate the utilization of the comparable product.
 - 4. The contractor shall bear all responsibility including any changes to mechanical, plumbing, electrical, structural or architectural design. These changes shall be clearly identified and presented to the Design Team.

1.15 SUBMITTALS:

- A. General
 - 1. Refer to the Conditions of the Contract (General and Supplementary), Division 1.
 - 2. Contractor shall provide a submittal schedule appropriate for the size and schedule of the project. Limit the number of large submittals being reviewed at one time and coordinate timing of sections that are dependent on each other, i.e., submit coordination and short circuit study prior to or together with gear, overcurrent protection devices, ATS, etc.
 - 3. The Contractor shall identify any "long lead time" items which may impact the overall project schedule. If these submittal requirements affect the schedule, the Contractor shall identify the impacts and confer with the Engineer within two weeks of entering into the contract.
 - 4. The front of each submittal package shall be identified with the specification section number, job name, Owner's project number, date, Prime Contractor and Subcontractor's names, addresses, and contact information, etc. Each Specification Section shall be submitted individually, and submittal shall be tabbed for the equipment/materials/etc. within the section. Submittals that are not complete with the required information will not be reviewed and will be sent back to be corrected.
 - 5. Submittals shall be provided electronically. All electronic submittals need to be complete with all design information and stamped for conformity by the contractor. Submittals will be reviewed, marked appropriately, and returned by the same means received.
 - 6. An index shall be provided which includes:
 - a. Product
 - b. Plan Code (if applicable)
 - c. Specification Section
 - d. Manufacturer and Model Number
 - 7. Submittal schedule shall be provided for review within four (4) working weeks from award of contract to successful bidder.
- B. Basis of Design: The manufacturer's material or equipment listed first in the specifications or on the drawings are the basis of design and are provided for the establishment of size, capacity, grade, and quality. If the contractor proposes alternates or substitutions in lieu of the first names, the cost of any changes in construction required by their use shall be borne by this Contractor.
- C. All equipment shall conform to the State and/or local Energy Conservation Standards
- D. Contractor Review: Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Each submittal shall be reviewed by the contractor for general conformance with contract requirements and stamped by the respective contractor prior to submittal to the Architect/Engineer. Any submittal not stamped or complete will be sent back. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed unless written prior approval is obtained by the Contractor.
- E. Submittal Review Process: Before starting work, prepare and submit to the Architect/Engineer shop drawings and descriptive product data required for the project. Continue to submit in the stated format after each Architect/Engineer's action until a "No Exception Taken" or "Make Correction Noted" action is received. When a "Make Corrections Noted" is received, make the required corrections for inclusion in the operation and maintenance manual (O&M). Submittals marked "Make Corrections Noted" shall not be resubmitted during the submittal process. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned "Revise and Resubmit". Where an entire submittal package is returned for action by the Contractor, the Engineer may summarize comments in letter format and return the entire set. Submittals shall be prepared

per the ELECTRICAL SUBMITTAL CHECKLIST, at the end of this section; supplemental requirements are listed in each Division 26 Section.

- F. The Design Professional's review and appropriate action on all submittals and shop drawings is only for the limited purpose of checking for conformance with the design concept and the information expressed in the contract documents. This review shall not include:
 - 1. Accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes
 - 2. Construction means or methods
 - 3. Coordination of the work with other trades
 - 4. Construction safety precautions
- G. The Design Professional's review shall be conducted with reasonable promptness while allowing sufficient time in the Design Professional's judgment to permit adequate review. Review of a specific item shall not indicate that the Design Professional has reviewed the entire assembly of which the item is a component.
- H. The Design Professional shall not be responsible for any deviations from the contract documents not brought specifically to the attention of the Design Professional in writing by the Contractor. This shall clearly identify the design and the specific element which vary from the Design. The Contractor shall be responsible for all remedy for lack of strict conformance associated with these criteria.
- I. The Design Professional shall not be required to review partial submissions or those for which submissions of correlated items have not been received.
- J. If more than two submittals (either for product data, shop drawings, record drawings, test reports, or O&Ms are made by the Contractor, the Owner reserves the right to charge the Contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the Contractor.
- K. The contractor shall cloud all changes made on submittals that are marked "Revise and Resubmit."
- L. Required Submittals: Provide submittals for each item of equipment specified or scheduled in the contract documents. See table at the end of this section.
- M. Submit letters certifying compliance with ANSI standards for medium or high voltage gear. These letters shall be signed by a corporate officer and shall list applicable standards. Letters signed by local representatives will not be acceptable.
- N. Submit proposed changes to electrical room or other equipment room layouts when revised from contract documents prior to installation.
- O. Mark submittals with designations as shown on the drawings and identify as required by specification sections. Identification shall contain the information as required in details and each label shall be submitted in list form with disconnects, panelboards, switchboards, overcurrent protection devices and utilization equipment.
- 1.16 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS:
 - A. Product Listing:
 - 1. Prepare listing of major electrical equipment and materials for the project, within (2) two weeks of signing the Contract Documents and transmit to the Architect
 - a. Provide all information requested.

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- b. Submit this listing as a part of the submittal requirement; see Paragraph 1.15 "PRODUCT OPTIONS AND SUBSTITUTIONS."
- 2. Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice.
- 3. When two or more items of same material or equipment are required (lighting, wiring devices, switchgear, panelboards, protective devices, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials steel bar stock, welding rods, solder, fasteners, except as otherwise indicated.
 - a. Provide products which are compatible within systems and other connected items.
- 4. For conduit, wire and fittings, the Contractor shall select a prime and alternate manufacturer from the list of acceptable manufacturers provided in the appropriate sections of this Division. The prime and alternate manufacturers shall be identified in the product listing. The contractor shall make every effort to use the prime manufacturer for the entire project. If products from this manufacturer are unavailable, the Contractor shall use the listed alternate with the following provisions.
 - a. Wire: All wire placed in a single conduit or installed in multiple conduits making up parallel feeders shall be of the same manufacturer.
 - b. Conduit and Fittings: All conduits and fittings installed exposed within the same room or immediate area shall be of the same manufacturer.
- B. Product Data:
 - 1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy to indicate which of the variations is to be provided.
 - 2. Delete or mark-out portions of pre-printed data which are not applicable.
 - 3. Where operating ranges are shown, mark data to show portion of range required for project application.
 - 4. For each product, include the following:
 - a. Sizes.
 - b. Weights.
 - c. Speeds.
 - d. Capacities.
 - e. Conduit and electrical connection sizes and locations.
 - f. Statements of compliance with the required standards and regulations.
 - g. Performance data.
 - h. Manufacturer's specifications.
 - i. Housing and proposed finishes.
 - j. NEMA or other ratings that apply.
 - 5. Checklist: Where identified in ELECTRICAL SUBMITTAL CHECKLIST or within individual Division 26 Sections or necessary for confirmation of products, submit a detailed checklist which acknowledges compliance or a reason for non-compliance to each of the specification requirements. Arrange the checklist according to the headings of each item identified in each specification (i.e. Shop Drawings, Wiring Diagrams, Product requirements, individual line items, etc.) Mark items as "N/A" where the item is not applicable.
- C. Shop Drawings:
 - 1. Shop Drawings are defined as electrical system layout drawings prepared specifically for this project, or fabrication and assembly type drawings of system components to show more detail than typical preprinted materials.

- 2. Prepare Electrical Shop Drawings, except diagrams, to accurate scale, min 1/8"=1'-0", Electrical rooms shall be 1/4"=1'-0" unless otherwise noted.
- 3. Shop drawings shall include:
 - a. Proposed equipment installations.
 - b. Electrical characteristics and connection requirements.
 - c. Clearance dimensions at critical locations.
 - d. Dimensions of spaces required for operation and maintenance.
 - e. Interfaces with other work, including structural support.
 - f. Elevations in areas with multiple pieces of equipment on common walls or to clarify incoming/exiting methods/clearances, etc.
 - g. Wall and floor penetrations.
 - h. Wiring diagrams shall showing all components, internal connecting wiring, and contractor connection requirements including terminal blocks/lugs, wire sizes, etc.
- D. Test Reports:
 - 1. Submit test reports which have been signed and dated by the accredited firm or testing agency performing the test.
 - 2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.
 - 3. Submit test reports as required for O & M manuals.
- E. Equipment Settings Report: Where identified in the ELECTRICAL SUBMITTAL CHECKLIST or within individual Division 26 Sections or necessary for confirmation of products, submit Equipment Settings Report for each device indicating final configurations and settings.
 - 1. Provide report of settings, parameters, programing inputs and parameters, etc., installed at each piece of electrical equipment that allows adjustments to be made in the field and those set at the factory. The report shall be arranged by specification section and each piece of equipment broken out individually or by listing of equipment if the same settings are installed in multiple pieces of equipment.
 - 2. In addition to the requirements above, include within this report any individual ground fault system settings; zone interlock operational settings; Arc Flash reduction schemes and levels; transfer switch settings including time delays and upstream protection device settings with copies of listed OCPD's for each ATS; settings of monitoring equipment including trip levels and alarm levels; Generator settings and parameters; UPS settings and parameters; relay settings; transformer tap settings; phase rotation documentation; lighting control settings with associated timer settings; electrical interlock and/or kirk key system descriptions; posted operational signage; and any other pertinent information.
 - Report shall be submitted and received by the Engineer at least fifteen calendar days prior to the contractor's request for final observation. Include in the O & M Manual after review and "No Exceptions Taken" has been accomplished.
- F. Software Licenses: Provide documentation of ownership under the owner's corporate name (coordinate with owner's representative for exact ownership wording) for Software Licenses provided as part of the work. Include information for updates, subscription requirements if applicable, backup, support, login, passwords, date when purchased, expiration date if applicable, version, etc. Include in the O & M Manual after review and "No Exceptions Taken" has been accomplished.
- 1.17 DELIVERY, STORAGE AND HANDLING:
 - A. Refer to the Division 1, Sections on Transportation and Handling and Storage and Protection.
 - B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

- C. Check delivered equipment against contract documents and submittals.
- D. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage and weather.
- E. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.18 DEMOLITION/REMODEL WORK:

- A. Refer to Division 1 Section on Summary of work for requirements on working in Owner-occupied areas of the existing building and Division 2 section on selective demolition. The following paragraphs supplement the requirements of other Divisions.
- B. During the demolition phase of this contract, it is the responsibility of this Contractor to carefully remove existing equipment, conduits, boxes, and related items either as shown on the demolition drawings as being removed, or as required for the work. These items shall be tagged, protected from damage, and stored as directed by the Owner. A list of all items stored shall be turned over to the Architect/Engineer. At the completion of the remodeling work or when directed by the Architect, all stored items not reused or wanted by the Owner shall be removed from the premises.
- C. The project involves renovation and remodel of the existing building. On the drawings, work may be denoted by showing items as bold or light line weight and certain renovation symbols are used. These indications and symbols are amplified as follows:
 - 1. **Bold Print** (when used): Work included in this contract is denoted in bold print or darker line weight.
 - 2. Light Print (when used): Work shown lightly indicates existing conditions to remain. R = Existing item to be removed. Contractor shall remove the existing item and the associated existing wiring. Where the raceway serving the equipment is accessible (via removal of suspended ceiling, crawl space, etc.) the raceway shall also be removed. Where the removal of a raceway leaves visible evidence on an existing surface which is not being repaired or replaced by the General Contractor, this contractor shall repair the surface. Where the existing raceway is concealed, the outlet box shall be cleaned, and a blank cover-plate installed. Where the concealed raceway is uncovered by demolition performed by the General Contractor, the raceway shall be removed (or extended to new location if appropriate).
- D. Existing equipment that is removed and not scheduled to be reused shall remain the property of the Owner and be delivered for disposition unless specifically indicated otherwise and shall be stored in a location designated by the Owner. Items which are removed and not wanted by the Owner shall become the property of the Contractor and shall be removed from the site.
- E. Existing equipment that is removed and is to be reused shall be cleaned, serviced and operable before being reinstalled.
- F. Revise panelboard schedules to reflect removal or relocation of equipment. Circuit integrity of equipment in adjacent areas shall be left intact.
- G. Where remodeling interferes with existing circuits and equipment which are not to be removed, such circuits and equipment shall be reworked and relocated as required to complete the project.
- H. The Contractor shall remove all distribution equipment, conductors, etc., which are indicated to be removed or which must be removed to accommodate demolition. Equipment to be removed may require reworking conduit and wiring to maintain service to other equipment.

- I. Where remodeling interferes with circuits serving areas outside of the project or phase limits or which are remodeled in later phases of the project, circuits shall be reworked, or temporary circuits provided as required.
- J. Existing equipment and circuiting shown are based on field surveys and/or Owner furnished drawings. The Contractor shall verify conditions as they exist with necessary adjustments being made to the drawing information.
- K. Electrical Outages: Electrical outages must be held to a minimum. The Contractor shall submit a Method of Procedure (MOP) for each outage to the Owner, detailing the reasons for the outage, areas affected, sequence of procedures to accomplish work, estimated maximum length of time along with the date and time of day outage will occur. The Contractor shall meet with the Owner to set a schedule and date for the outage based on the MOP. Due to the critical implications of power outages, the Owner may direct the Contractor as to the time of day or night and date an outage may take place.
 - 1. The Contractor will be responsible for providing temporary power required for the duration of the outages. The required outages to connect and disconnect the temporary power will require a MOP as described above.
 - 2. Log each approved and implemented MOP and submit with O&M Manuals.
- L. PCB Ballasts: PCB type ballasts may be present in existing luminaires. If PCB ballasts are discovered by the Contractor, report such occurrence to the Owner immediately. The Contractor shall remove and dispose of PCB type ballasts at an E.P.A. (Environmental Protection Agency) approved site in the prescribed manner acceptable to the EPA. The Contractor shall pay all fees associated with this work.
- M. Hazardous Material: If suspected hazardous material, in any form, is discovered by this Contractor in the process of his work, he shall report such occurrence to the Owner immediately. The Owner will determine the action to be taken. Hazardous material removed is not a part of the work to be done under this Division.
- N. Lamp Disposal: Contractor is responsible for sending removed lamps to be recycled. The Contractor shall ensure the recycling agency meets RCRA and CERCLA regulations. Provide certificate of compliance in O&M Manuals.
- O. On-Site Metering: When called for in the specifications or on the drawings, the Contractor shall meter the points indicated for a period of 30 days prior to submitting for permit to verify existing load. Meter shall record voltage; amperage; KVA; and Power Factor for each phase and sum of the phases. The meter shall continually average the power demand over maximum 15-minute intervals as required by NEC 220.87. Compile a metering summary report and deliver results to engineer after 7 days and after 30 days. Verify existing loads at and downstream of the metering location and provide list to engineer of what loads are not on during the 30-day metering and the reason why. Organize list by equipment name. If any loads have been removed or permanently abandoned, turn circuit breaker off and relabel as SPARE.

1.19 CUTTING AND PATCHING:

- A. Cutting and patching of electrical equipment, components, and materials may be required for removal and legal disposal of selected materials, components, and equipment. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
- B. Refer to Division 1 for cutting and patching requirements.
- C. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- D. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.

- E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or nonconforming installations.
- F. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work.
 - 2. Remove and replace defective work.
 - 3. Remove and replace work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed work as specified for testing.
 - 5. Install equipment and materials in existing structures.
 - 6. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect/Engineer observation of concealed work.
- G. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of conductors, conduit, luminaires, boxes, devices and other electrical items made obsolete by the new work.
- H. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- J. Locate, identify, and protect electrical services passing through remodel or demolition area and serving other areas required to be maintained operational.
- K. When coring is required or identified, an x-ray of the area is to be taken prior to the performance of the work operation. X-ray work requires an MOP and protection.
- 1.20 ROUGH IN:
 - A. Verify final locations for rough ins with field measurements and with the requirements of the actual equipment to be connected.
 - B. Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough in requirements.
 - C. Work through all coordination before rough in begins.

1.21 ACCESSIBILITY:

- A. Install equipment and materials to provide required code clearances and access for servicing and maintenance. Coordinate the final location with piping, ducts, and equipment of other trades to insure proper access for all trades. Coordinate locations of concealed equipment, disconnects, and boxes with access panels and doors. Allow ample space for removal of parts, fuses, lamps, etc. that require replacement or servicing.
- B. Extend all conduits so that junction and pull boxes are in accessible locations.
- C. Provide access panel or doors where equipment or boxes are concealed behind finished surfaces.
- D. Furnish hinged steel access doors with concealed latch, whether shown on drawings or not, in all walls and ceilings for access to all concealed valves, shock absorbers, air vents, motors, fans, balancing cocks, and

other operating devices requiring adjustment or servicing. Refer to Division 1 for access door specification and requirements.

- E. The minimum size of any access door shall not be less than the size of the equipment to be removed or 12 inches x 12 inches if used for service only.
- F. Furnish doors to trades performing work in which they are to be built, in ample time for building in as the work progresses. Whenever possible, group equipment to permit use of minimum number of access doors within a given space.
- G. Factory manufactured doors shall be compatible with the finish in which they are to be installed.
- H. Access doors in fire-rated walls and ceilings shall have equivalent U.L. label and fire rating.

1.22 TESTING:

- A. Submit test reports as outlined in Division 1 Sections on Quality Control Services and each Division 26 Section.
- B. Testing as required by these specifications shall pertain to all equipment, wiring, devices, etc. installed under this contract and being reused.
- C. General Scope:
 - 1. Perform all tests and operational checks to assure that all electrical equipment, both Contractor and Owner-supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.
 - 2. The tests and operational checks shall determine the suitability for energization.
 - 3. Schedule tests and give a minimum of two weeks advance notice to the Architect/Engineer. Reschedule testing for Owner convenience if required.
- D. Test Report: Submit the completed report to the Architect/Engineer no later than fifteen (15) days after completion of test unless directed otherwise. The test report shall be bound, and its contents certified. A final compilation of all Test Reports shall be submitted with the Testing and Equipment Settings Report (Refer to Operation and Maintenance Data paragraphs).
- E. Each test report shall include the following:
 - 1. Project information including building name, address, date, and other pertinent information.
 - 2. List of equipment tested.
 - 3. Description of test.
 - 4. List of test equipment used and calibration date.
 - 5. Baseline, acceptable, or published target value for test with code or standard reference indicating where value was derived.
 - 6. Test results that summarize all measured values with baseline values.
 - 7. Conclusions and recommendations.
 - 8. Appendix, including appropriate test forms that show all measured values.
- F. Failure to Meet Test:
 - 1. Any system material or workmanship which is found defective based on performance tests shall be reported directly to the Architect/Engineer.
 - 2. All failed tests shall be sent immediately by email to Architect/Engineer with proposed corrective action and proposed re-test date and time.

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- 3. Contractor shall replace the defective material or equipment as necessary, and have test repeated until test proves satisfactory without additional cost to the Owner.
- G. The testing agency shall have a calibration program which maintains all applicable test instrumentation within rated accuracy. The accuracy shall be traceable to the National Institute of Standards and Technology (NIST) in an unbroken chain. Instruments shall be calibrated in accordance with the following frequency schedule:
 - 1. Field Instruments: 6 months
 - 2. Laboratory Instruments: 12 months
 - 3. Leased specialty equipment: 12 months. (Where accuracy is guaranteed by lessor
 - 4. Dated calibration labels shall be visible on all test equipment.

1.23 EXCAVATING AND BACKFILLING:

- A. General:
 - 1. Provide all necessary excavation and backfill for installation of electrical work in accordance with Division 2.
 - 2. Follow all regulations of OSHA as specified in Part 1926, Subpart P, "Excavations, Trenching and Shoring." Follow specifications of Division 26 as they refer specifically to the electrical work.
- B. Contact Owners of all underground utilities to have them located and marked, at least 2 business days before excavation is to begin. Prior to starting excavation, brief employees on marking and color codes and train employees on excavation and safety procedures for Utilities including electrical lines and natural gas lines. When excavation approaches electrical or gas lines, expose lines by carefully probing and hand digging.
- C. Trenching:
 - 1. Provide all necessary pumping, cribbing, and shoring.
 - 2. Walls of all trenches shall be a minimum of 6 inches clearance from the side of the nearest electrical work. Install conduits with a minimum of 6 inches (or as identified on the drawings) clearance between them when located in same trench.
 - 3. Dig trenches to depth, width, configuration, and grade appropriate to the materials being installed. Dig trenches to 6 inches below the level of the bottom of the material to be installed. Install 6 inches bed of sand, pea gravel, or squeegee, mechanically tamp to provide a firm bed, true to line and grade without irregularity. Provide depressions only at hubs, couplings, flanges, or other normal protrusions.
- D. Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be accepted by the soils engineer. In no case shall lumber, metal or other debris be buried with backfill.
 - 1. Provide warning tape for marking and locating underground utilities. Tape shall be specifically manufactured for this purpose and shall be polyethylene film, 6 inches wide, 0.004 inches thick and have a minimum strength of 1750 psi. Tape shall carry continuous inscription naming the specific utility.
 - a. Tape shall have magnetic strip and be used for exterior underground system only.
- E. Trench Backfill
 - 1. Backfill to 4 inches above top of conduits with sand, the same as used for conduit bed, compact properly.
 - Continue backfill to finish grade, using friable material free of rock and other debris. Install in 6-inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is not permissible.

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- F. After backfilling and compacting, any settling shall be refilled, tamped, and refinished at contractor's expense.
- G. This contractor shall repair and pay for any damage to finished surfaces.
- H. Backfill near manholes or hand holes using sand, installing it in 6-inch layers to 4 inches above the shallowest conduit. Use suitable excavated material to complete the backfill, installed in 6-inch layers and mechanically compacted to seal against water infiltration. Compact to 95% below paving and slabs and 90% elsewhere.
- I. Use suitable excavated material to complete the backfill, installed in 6-inch lifts and mechanically compacted to seal against water infiltration. Compact to 95 percent for the upper, 30 inches below paving and slabs and 90 percent elsewhere.

1.24 NAMEPLATE DATA:

- A. Provide equipment with permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Install equipment so that nameplate is readily visible.
- B. Phase Rotation
 - 1. New Building: Provide a label at service entrance main disconnect and the generator tap box indicating phase rotation for the building.
 - 2. Existing Building: Match existing phase rotation.
- 1.25 METHODS OF PROCEDURE (MOP):
 - A. Definition: Method of Procedure (MOP) is a written plan which describes the activities and procedures to safeguard the building's occupants and contents and to interface with the building's management, operations, and security. Building occupants shall be defined as employees, patients, and visitors.
 - B. Requirements:
 - 1. An MOP is required when a construction activity affects the safety of the occupants, equipment or valuable contents, or any supporting system; or essentially affects the building's management, operations, or security.
 - 2. An MOP is required for any shutdown or interruption of any system which affects the building occupants, including, but not limited to, infrastructure, life safety, electrical, and building management systems.
 - 3. An MOP is required when requested or deemed necessary by the Owner or Engineer.
 - C. Development:
 - 1. The Prime Contractor shall develop, submit, track, and process the MOP. Any assistance required by the Subcontractors shall be provided. All MOPs shall be reviewed by the Prime Contractor prior to submitting the MOP to the Engineer.
 - 2. All MOPs Shall Be Typed.
 - 3. Contractor shall develop the MOP in a timely fashion prior to review and approval by all required parties.
 - 4. Contractor shall develop the MOP with input from the subcontractor, where necessary.
 - D. Form: Each MOP shall be a written document in narrative, descriptive or outline form supplemented with drawings, diagrams and schedules as necessary.

- E. Review and Approval: Contractor shall submit each MOP to the Engineer for review and approval. All MOPs require Owner's approval.
- F. Implementation: Contractor shall implement the MOP when approved by the Engineer and Owner in writing. No construction activity which requires a MOP shall proceed until the MOP is approved.
- G. Compliance: Contractor shall comply with the approved MOP. The Owner and Engineer reserve the right to stop the work for non-compliance with the MOP. Any cost or time delay resulting from the work stoppage shall be borne by the Contractor.
- H. Posting: Work shall not proceed on any facet of the work involving any MOP if an approved and signed MOP is not posted in the work area.
- 1.26 CLEANING:
 - A. Refer to the Division 1 Section on project closeout or final cleaning for general requirements for final cleaning.
- 1.27 RECORD DOCUMENTS:
 - A. Refer to the Division 1 Section on Project Closeout or Project Record Documents for requirements. The following paragraphs supplement the requirements of Division 1.
 - B. Keep a complete set of record document prints in custody during entire period of construction at the construction site. Documents shall be updated on a weekly basis.
 - C. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; concealed control system devices, and any other relevant deviations from the Contract Documents.
 - D. Mark shop drawings to indicate approved substitutions; Addenda; Change Orders; actual equipment and materials used.
 - E. Schedules:
 - 1. Mark schedules including panelboard, switchboard, motor control center, mechanical, kitchen and similar equipment schedules on drawings to indicate installed equipment and materials used, and any deviations or revisions to electrical load data and calculations.
 - F. Revisions to the Contract Documents shall be legible and shall be prepared using the following color scheme.
 - 1. Red shall indicate new items, deviations, and routing.
 - 2. Green shall indicate items removed or deleted.
 - 3. Blue shall be used for relevant notes and descriptions.
 - G. At the completion of the project, obtain from the Architect a complete set of the Contract Documents in a read-only electronic format (.pdf unless otherwise noted). This set will include all revisions officially documented through the Architect/Engineer. Using the above color scheme, transfer any undocumented revisions from the construction site record drawings to this complete set. Submit marked up and completed documents to the Architect/Engineer. This contract will not be considered completed until these record documents have been received and reviewed by the Architect/Engineer.

- H. Contractor may propose methods of maintaining record documents on electronic media. Obtain approval of Engineer and Owner prior to proceeding. Marked-up .pdf format readable by Bluebeam is preferred.
- I. One full size set of record drawing one-line diagrams shall be posted in the electrical room.

1.28 OPERATION AND MAINTENANCE DATA:

- A. Refer to the Division 1 Section on project closeout or operation and maintenance data for procedures and requirements for preparation and submittal of maintenance manuals.
- B. No later than four (4) weeks prior to the completion of the project provide complete set of operating and maintenance manuals, or as specified in Sections of Division 1 (whichever is more stringent). Operation and Maintenance Data shall be submitted in electronic format.
- C. Operation and Maintenance Data: Submit operation and maintenance data in maintenance manual in accordance with requirements of applicable Division 26 Sections and Division 1. Provide Operating and Maintenance Instructions in electronic format covering all equipment furnished. Manuals shall include all information required below, as indicated in each Division 26 Section, and the following for each piece of equipment:
 - 1. The job name and address, contractor's name, address, and phone number, and each subcontractor's name, address, and phone number shall be identified at the front of the electronic submittal.
 - Name, address, and telephone number to be contacted of the local authorized service organization/company and individual to be contacted for service and maintenance for each item of equipment.
 - 3. Submit operation and maintenance data, schedule of recommended service and parts lists for all materials and products specified and intended for installation. Include description of function, normal operating characteristics and limitations, fuse curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 4. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
 - 5. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 6. Servicing instructions and lubrication charts and schedules.
 - 7. Manufacturer's service manuals for all electrical equipment provided under this contract.
 - 8. Complete equipment and protection wiring diagrams. All wiring diagrams shall show color coding of all connections and mounting dimensions of equipment.
 - 9. Equipment identification numbers and adjustment clearly indicated for each piece of equipment.
 - 10. Electrical System and Equipment Warranties.
 - 11. Provide manuals tabbed and divided into major sections and special equipment. Mark the individual equipment when more than one model or make is listed on a page. Provide detailed table of contents.
 - 12. Record Set of Shop Drawings: Shop drawings corrected to show as-built conditions. Transfer modifications from field set.
 - 13. Equipment Testing Report including all test reports and Equipment Settings Report indicating final configurations and settings.
- D. This contract will not be considered completed nor will final payment be made until all specified material, including test reports, settings reports, and final Schedule of Values with all Electrical and Information Technology change order costs included and identified is provided and the manual is reviewed by the Architect/Engineer.

1.29 PROJECT CLOSEOUT LIST:

- A. In addition to the requirements specified in Division 1, complete the requirements listed below.
 - 1. The contractor shall be responsible for providing the items listed on the Electrical Submittal Checklist prior to applying for certification of substantial completion. Refer to individual specification sections for additional requirements (Checklist is located at the end of this section.)
 - 2. Final payment will not be authorized until all items on the final punch list have been complete.

1.30 WARRANTIES:

- A. Refer to the Division 1 Section on Warranties and Bonds for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. In no case shall the warranty for the total electrical system be less than one year from date of acceptance by the Owner.
- B. Compile and assemble the warranties specified in Division 26, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each item. Information to include product or equipment description, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.31 CONSTRUCTION REQUIREMENTS:

- A. The contractor shall maintain and have available at the jobsite current information on the following at all times:
 - 1. Up-to-date record drawings.
 - 2. Addenda
 - 3. Change Orders
 - 4. Submittals
 - 5. Site observation reports with current status of all action items.
 - 6. Test results; including recorded values, procedures, and other findings.
 - 7. Outage information.

1.32 EQUIPMENT HOUSEKEEPING PADS:

- A. Provide 4" concrete housekeeping pad for all floor mounted equipment including, but not limited to: switchgear, switchboards, motor control centers, floor mounted distribution panelboards, floor mounted branch panelboards, floor mounted VFD's and starter cabinets, and floor mounted dry type transformers. Fabricate pads as follows:
 - 1. Coordinate size of equipment bases with actual unit sizes provided. Fabricate base 4" larger in both directions than the overall dimensions of the supported unit.
 - Form concrete pads with framing lumber with form release compounds. Chamfer top edge and corners of pad.
 - 3. Place concrete and allow curing before installation of units. Use Portland cement that conforms to ASTM C 150, 54000-psi compressive strength, and normal weight aggregate.
 - 4. Anchor housekeeping pads to slab using #3 rebar bent in "L" or "Z" shape 12 inch on center on each side of slab.

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1.33 ELECTRICAL SUBMITTAL CHECKLIST:

A. Provide submittals including shop drawings, product data, product checklists, tests and reports, training, extra material, coordination drawings, record drawings, O&M manuals, device setting reports, and software licenses per the following schedule:

C – Product Checklist; Q – Qualifications, CD – Coordination Drawings, RD - Record Drawings, D – Device Setting Report; S – Software License, W – Special Project Warranty

		Requirements									
SPEC Section	TITLE	Repor	t Data	Test	Factory Test	Factory Rep		- · ·	Ester		Other
		Shop Drawings	Product Data			Report	Supervision at Site	Req'd at Site	Material	O&M	
26 05 00	Common Work Results For Electrical										
	Existing Conditions Survey Drawings	х									
	Utility Company Final Parameters, Measurements, Equipment, and Contacts	x	х	х		х				Х	D
	Seismic Design Parameters per Local Authority	х	Х			х				Х	
	Temporary Facilities	х	Х			х					
	Product Listing		х							Х	С
	Electrical On-Site Metering Reports			х		х				Х	
	Tests	Х	Х	х	х	х	Х	Х		Х	D
	Completed/Signed MOP's					х				Х	
	Record Drawings including changes to existing Equip.	х								Х	
	O&M Manuals	х	х	х	х	х			х	Х	C,D,S
	Project Closeout List					х				Х	
	Contractor/Equipment Warranties					х				х	
26 05 19	Low Voltage Electrical Power Conductors And Cables		х	х		х				х	
26 05 26	Grounding And Bonding For Electrical Systems	х	Х	х		х				х	
26 05 29	Hangers And Supports For Electrical Systems	х	Х							х	
26 05 33	Raceway And Boxes For Electrical Systems	х	Х								CD, RD
	Conduit		Х								CD, RD
	Wireways	х	х							Х	CD, RD
26 05 34	Cabinets, Boxes & Fittings	х	х								CD, RD
26 05 43	Underground Ducts And Raceways For Electrical Systems	х	х			x				х	CD, RD
	Junction Boxes	Х	Х							Х	CD, RD
	Pull Boxes	х	Х							Х	CD, RD
26 05 53	Identification For Electrical Systems	х	х							х	

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C – Product Checklist; Q – Qualifications, CD – Coordination Drawings, RD - Record Drawings, D – Device Setting Report; S – Software License, W – Special Project Warranty

	TITLE	Requirements										
SPEC Section		Report Data			Factory		Factory Rep	Training	Extro		Other	
		Shop Drawings	Product Data	Test	Test	Report	Supervision at Site	Req'd at Site	Material	O&M		
26 05 83	Wiring Connections	х	х	х							D	
26 27 26	Wiring Devices		х	х		х				х		
26 28 00	Low Voltage Circuit Protective Devices	x	х	х		х		х	х	х	C, D.S	

END SECTION 26 05 00

SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

- 1.1 SUMMARY:
 - A. This section includes wires, cables, and connectors for power, lighting, signal, control, and related systems rated 600 volts and less.
- 1.2 QUALITY ASSURANCE:
 - A. Manufacturers: Firms regularly engaged in the manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.
 - C. Conform to applicable code regulations regarding toxicity of combustion products of insulating materials.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product Data: Submit manufacturer's data on electrical wires, cables, and connectors.
- 1.4 DELIVERY, STORAGE, AND HANDLING:
 - A. Deliver wire and cable properly packaged in factory fabricated type containers or wound on NEMAspecified type wire and cable reels.
 - B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
 - C. Handle wire and cable carefully to avoid abrading, puncturing, and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS:
 - A. Manufacturers: Subject to compliance with requirements, provide products by the following (for each type of wire, cable, and connector):
 - 1. Wire and Cable:
 - a. Belden
 - b. Cerrowire
 - c. Encore Wire
 - d. General Cable Corporation.
 - e. Southwire Company

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- f. Okonite
- g. Superior Essex
- 2. Connectors:
 - a. Emerson
 - b. AMP, Inc.
 - c. Burndy Corporation.
 - d. Ideal Industries, Inc.
 - e. 3M Company
 - f. ABB
- 2.2 WIRES AND CABLES:
 - A. General: Provide wire and cable suitable for the temperature, conditions, and location where installed.
 - B. Conductors: Provide solid or stranded conductors and approved connectors for power, control, and lighting circuits 10 AWG and smaller. Provide stranded conductors for 8 AWG and larger.
 - C. Conductor Material: Provide copper for all wires and cables.

2.3 CONNECTORS:

- A. Description: Provide UL-type, factory fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperatures equal to or greater than those of the wires upon which used.
- B. Provide 2-hole compression lugs for all power feeder, neutral, and grounding connections when installed on bus bars. (Including phase, neutral and grounding conductors).
- C. Provide connectors that are designed to accept stranded conductors where stranded conductors are used.

PART 3 - EXECUTION

- 3.1 WIRE AND CABLE INSTALLATION SCHEDULE:
 - A. Building Wire: Install all building wire in raceway regardless of location.
- 3.2 INSTALLATION OF WIRES AND CABLES:
 - A. General: Install electrical cables, wires, and connectors in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
 - B. Coordinate wire/cable installation work, including electrical raceway and equipment connection work, with other work.
 - C. Pull conductors simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.
 - D. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceway. Do not use rope hitches for pulling attachment to wire or cable.

- E. Keep conductor splices to a minimum. Splice only in accessible junction boxes. No splices are allowed in feeder, control, or fire alarm wiring. Connect un-spliced wire to numbered terminal strips at each end.
- F. Install splices and taps which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- G. Use splice and tap connectors which are compatible with conductor material.
- H. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A for copper and 486B for aluminum.
- I. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled to individual circuits. Make terminations so there is no bare conductor at the terminal.
- J. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and larger. For 10 AWG and smaller, use insulated screw on type spring wire connectors with plastic caps, push on type is not acceptable.
- K. Use copper compression connectors for copper wire splices and taps, 1/0 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of the conductor.
- L. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- M. Thoroughly tape the ends of spare conductors in boxes and cabinets.
- N. Install exposed cable, parallel and perpendicular to surfaces, or exposed structural members, and follow surface contours, where possible.
- O. Make all ground, neutral and line connections to receptacle and wiring device terminals as recommended by manufacturer. Provide ground jumper from outlet box to individual ground terminal of devices.
- P. Branch circuits whose length from panel to first outlet exceeds 100 feet for 120-volt circuits or 175 feet for 277-volt circuit shall be 10 AWG or larger, as required to comply with the National Electrical Code.
- Q. Parallel conductors shall be cut to the same length.
- R. Provide wire training, lacing, labeling, and terminal blocks as required in panelboards and all control cabinets including, but not limited to, lighting, transfer switch, fire alarm, and security cabinets. All wiring shall be installed neat and be labeled to match wiring diagrams, control devices, etc.
 - 1. Make temporary connections to panelboard devices with sufficient slack conductor to facilitate reconnections required for balancing loads between phases.

3.3 FIELD QUALITY CONTROL:

A. Test installed wires and cables with 1000 VDC megohm meter to determine insulation resistance levels to ensure requirements are fulfilled. Test shall be made on all feeders regardless of size and on all branch circuits with No. 4 AWG and larger conductors. The megger values obtained shall be compared to the minimum values listed in NETA. All phase conductors and cables shall be meggered after installation, and prior to termination. Submit test report.

- B. Prior to energization, test wires and cables for electrical continuity and for short circuits.
- C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.
- 3.4 COLOR CODING SCHEDULE:
 - A. Color code secondary service, feeder, and branch circuit conductors as follows:

120/208 Volts	Phase	277/480 Volts
Black	А	Brown
Red	В	Orange
Blue	С	Yellow
White	Neutral	Gray
Green	Ground	Green

- B. Conductors shall be solid color for entire length.
- C. If solid color conductor insulation is not available and specific acceptance is given by the engineer for use of black conductor insulation, provide the following:
 - 1. Conductors 6 AWG and smaller shall be solid color for the entire length.
 - 2. Conductors 4 AWG and larger shall have either solid color insulation as specified above for the entire length or be black with color coding at each termination and in each box or enclosure. For 6 inches use half-lapped 3/4-inch plastic tape in the above specified color. Do not cover cable identification markings. Adjust tape locations to prevent covering of markings.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

- 1.1 SUMMARY:
 - A. This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

1.2 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product data for ground rods, connectors and connection materials, and grounding fittings.
- C. Wiring Diagrams: Submit wiring diagrams for electrical grounding and bonding work which indicates layout of ground rings, location of system grounding electrode connection, routing of grounding electrode conductors, also include diagrams for circuits and equipment grounding connections.

1.3 QUALITY ASSURANCE:

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.
- B. Manufacturer's Qualifications: Firms regularly engaged in manufacture of grounding and bonding products, of types, and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, grounding electrodes and plate electrodes, and bonding jumpers whose products have been in satisfactory use in similar service for not less than 5 years.
- C. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical grounding work similar to that required for project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Burndy Corporation
 - 2. Cadweld Div.; Erico Products Inc.
 - 3. Ideal Industries
 - 4. OZ Gedney Div.
 - 5. Thermoweld
 - 6. Thomas and Betts Corp.

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- 2.2 GROUNDING AND BONDING PRODUCTS:
 - A. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.
 - B. Conductor Materials: Copper.
- 2.3 WIRE AND CABLE CONDUCTORS:
 - A. General: Comply with Division 26 Section on Wires and Cables. Conform to NEC, except as otherwise indicated, for conductor properties, including stranding.
 - B. Equipment Grounding Conductor: Green insulated.
 - C. Grounding Electrode Conductor: Stranded cable.
 - D. Bare Copper Conductors: Conform to the following:
 - 1. Solid Conductors: ASTM B-3
 - 2. Assembly of Stranded Conductors: ASTM B-8
 - 3. Tinned Conductors: ASTM B-33
- 2.4 MISCELLANEOUS CONDUCTORS:
 - A. Ground Bus: Bare annealed copper bars of rectangular cross section.
 - B. Braided Bonding Jumpers: Copper tape, braided No. 30 gage bare copper wire, terminated with copper ferrules.
 - C. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.
- 2.5 CONNECTOR PRODUCTS:
 - A. General: Listed and labeled as grounding connectors for the materials used.
 - B. Pressure Connectors: High-conductivity-plated units.
 - C. Bolted Clamps: Heavy-duty units listed for the application.
 - D. Exothermic Welded Connections: Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.
- 2.6 GROUNDING ELECTRODES:
 - A. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
 - 1. Size: 3/4-inch by 10 feet.

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 3 - EXECUTION

3.1 APPLICATION:

- A. Equipment Grounding Conductor: Comply with NEC for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.
 - 1. Install separate insulated equipment grounding conductors with circuit conductors for the following in addition to those locations where required by Code:
 - a. Feeders and branch circuits.
 - 2. Nonmetallic Raceways: Install an insulated equipment ground conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- B. Underground Conductors: Bare, tinned, stranded copper except as otherwise indicated.
- C. Signal and Communications: For telephone, alarm, and communication systems, provide a #6 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location.
- D. All systems shall be grounded in accordance with the NEC.
- E. Connections to lightning protection system: Bond grounding conductors or grounding conductor conduits to lightning protection down conductors or grounding conductors in compliance with NFPA 780 "Lightning Protection Systems."
- F. Common ground bonding with lightning protection system: Bond electric power system ground directly to lightning protection system grounding conductor at closest point to electric service grounding electrode. Use bonding conductor sized same as system ground conductor and installed in conduit.

3.2 INSTALLATION:

- A. General: Ground electrical systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- B. Ground Rods: Locate a minimum of two rod lengths from each other and at least the same distance from any other grounding electrode. Interconnect ground rods with bare conductors buried at least 24 inches below grade. Connect bare cable ground conductors to ground rods by means of exothermic welds except as otherwise indicated. Make these connections without damaging the copper coating or exposing the steel. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated.
- C. Braided Type Bonding Jumpers: Install to connect ground clamps on water meter piping to bypass water meters electrically. Use elsewhere for flexible bonding and grounding connections.
- D. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.
- E. UFER Ground: Fabricate grounding electrode conductor by installing lengthwise in form for foundation or footings. Install so conductor is within 2 inches of the bottom of the concrete. Extend conductor below

grade and connect to building grounding grid, grounding electrode, or ground bar as required and as shown on plan drawings and details.

- F. Labeling: Provide a phenolic tag for all grounding electrode conductors as described in section on Electrical Identification.
- G. Where grounding conductors, grounding electrode conductors, or bonding conductors are non-exposed, identify each with a 6-inch band of green tape at each end and at 10-foot intervals. When run in conduits, provide color banding on conduit per section on Electrical Identification.

3.3 CONNECTIONS:

- A. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot coated materials to assure high conductivity and make contact points closer in order of galvanic series.
 - 2. Make connections with clean bare metal at points of contact.
 - 3. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.
- B. Exothermic Welded Connections: Use for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and plate electrodes. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors. Terminate each conductor on an individual ground lug terminal.
- D. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A.
- E. Compression Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.
- F. Moisture Protection: Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.
- 3.4 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING:
 - A. Pad Mounted Gear: Install a3/4-inch by 10 feet. Driven ground rod inside the cable access block-out of the pad and set the rod depth such that 4 inches will extend above the finished pad. Where necessary,

install ground rod before the equipment is placed. Protect ground rods passing through concrete with a double wrapping of pressure sensitive tape or heat shrink insulating sleeve from 2 inches above to 6 inches below the concrete.

B. Grounding System: Ground noncurrent carrying metallic items associated with pad mounted equipment by connecting them to grounding electrodes arranged as indicated.

3.5 FIELD QUALITY CONTROL:

- A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms, or less, by driving additional ground rods; then retest to demonstrate compliance.
- B. Ground Resistance Test:
 - Grounding electrode resistance testing shall be accomplished with a ground resistance direct-reading single test meter utilizing the fall-of-potential method and two reference electrodes. Perform test prior to interconnection to other grounding systems. Orient the ground electrode to be tested and the two reference electrodes in a straight line spaced fifty (50) feet apart. Drive the two reference electrodes five (5) feet deep.
- C. Correct Deficiencies, Retest and Report:
 - 1. Correct unsatisfactory conditions and retest to demonstrate compliance; replace conductors, units and rods as required to bring system into compliance.
 - 2. Prepare a written report and show temperature, humidity, and condition of soil at time of tests. Report shall be certified by testing agency that identifies components checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

3.6 CLEANING AND ADJUSTING:

A. Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other Work to their original condition. Include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching. Restore vegetation and disturbed paving to original condition.

END OF SECTION 26 05 26
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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

- 1.1 SUMMARY:
 - A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.
- 1.2 SUBMITTALS:
 - A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
 - B. Product data for each type of product specified.
 - 1. Hanger and support schedule showing manufacturer's figure number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.
 - C. Shop drawings indicating details of fabricated products and materials.
 - D. Engineered Design consisting of details and engineering analysis for supports for the following items:
 - 1. Suspended transformers
 - 2. Cable trays
 - 3. Trapeze hangers for multiple conduit runs.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS:
 - A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Slotted Metal Angle and U-Channel Systems:
 - a. Atkore
 - b. Eaton
 - 2. Conduit Sealing Bushings:
 - a. Eaton
 - b. Hubbell
 - c. ABB
- 2.2 COATINGS:
 - A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot dip galvanized.

- 2.3 MANUFACTURED SUPPORTING DEVICES:
 - A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
 - B. Fasteners: Types, materials, and construction features as follows:
 - 1. Expansion Anchors: Carbon steel wedge or sleeve type.
 - 2. Toggle Bolts: All steel springhead type.
 - 3. Powder-Driven Threaded Studs: Heat treated steel, designed specifically for the intended service.
 - C. Conduit Sealing Bushings: Factory fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
 - D. UChannel Systems: 12-gage steel channels, with 9/16-inch diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with Uchannel and are of the same manufacture.
 - E. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:
 - 1. One-Hole Conduit Straps: For supporting 1 inch and smaller rigid metal conduit; galvanized steel.
 - 2. Two-Hole Conduit Straps: For supporting larger than 1 inch metal conduit, galvanized steel; 3/4-inch strap width; and 2-1/8 inch between center of screw holes.
- 2.4 FABRICATED SUPPORTING DEVICES:
 - A. General: Shop or field fabricated supports or manufactured supports assembled from U-channel components.
 - B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
 - C. Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 1. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
 - 2. EMT, IMC, or Rigid Conduit.
- 2.5 FIRE SEALS:
 - A. Material: Fire stopping material shall be asbestos free, 100 percent intumescent, have code approval under BOCA, ICBO, SSBC, NFPA 101, NFPA 70, and be capable of maintaining an effective barrier against flame and gases in compliance with the following requirements.
 - B. Flame Spread: 25 or less, ASTM E84
 - C. Fire Resistance and Hose Stream Tests: Fire stopping materials shall be rated "F" and "T" in accordance with ASTM E 814 or UL 1479. Rating periods shall conform to the following:

- (F) 3 (T) 3 Time-rated floor or wall assemblies.
- (F) 3 (T) 3 Openings between floor slabs and curtain wall.
- D. Manufacturers: Subject to compliance with requirements, provide fire seals of the following:
 - 1. 3M Company
 - 2. STI
 - 3. Tremco
 - 4. Hilti

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.
- B. Coordinate with the building structural system and with other electrical installation.
- C. Junction Box Supports: Comply with the NEC and the following requirement:
 - 1. Use 1/4-inch all-thread rod from structure to support junction boxes.
- D. Raceway Supports: Comply with the NEC and the following requirements:
 - 1. Conform to manufacturer's recommendations for selection and installation of supports.
 - 2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs., provide additional strength until there is a minimum of 200 lbs. safety allowance in the strength of each support.
 - 3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
 - 4. Use #9 ceiling wire to support individual conduits up to 3/4-inch with spring steel fasteners. Use of ceiling support wires is unacceptable.
 - 5. Support parallel runs of horizontal raceways together on trapeze type hangers. Use 3/8-inch diameter or larger threaded steel rods for support.
 - 6. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing. For hanger rods supporting 1-1/2-inch or larger conduits provide 3/8-inch minimum threaded steel rods with pipe hangers.
 - 7. Space supports for raceways in accordance with NEC. When there are 4 or more 2-inch conduits in a trapeze, supports shall be spaced 5 feet O.C.

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- 8. In all runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.
- 9. Threaded rod supports to have bottoms cut off at a maximum length of 2-inches.
- 10. Attachment of electrical supports to piping, ductwork, mechanical equipment or conduit is not allowed.
- E. Miscellaneous Supports: Support miscellaneous electrical components separately and as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.
- F. In overhead spaces, support metal boxes directly from the building structure via 1/4-inch minimum allthread or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24-inches from the box. Supporting metal boxes utilizing ceiling type wire is not acceptable.
- G. Sleeves: Install in concrete slabs and walls and all other fire rated floors and walls for cable installations as required. Where sleeves through floors are installed, extend above finish floor. For sleeves through fire ratedwall or floor construction, apply ULlisted fire stopping sealant in gaps between sleeves and cables in accordance with "Fire Resistant Joint Sealers" requirement of Division 7 Section "Joint Sealers." See Architectural plans for location and extent of fire rated assemblies.
- H. Conduit Seals: Install seals for conduit penetrations of exterior walls below grade. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.
- I. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:
 - Fasten by means of wood screws on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts or self-drilling masonry anchors on concrete or solid masonry, cast in inserts on precast structures, spring tension clamps on steel. Drilling of structural steel members is prohibited. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws, where authorized by the Owner and structural engineer. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
 - 2. Coordinate with the owner and structural engineer and obtain written prior approval of all work on concrete beams. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
 - 3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

3.2 PERSONNEL PROTECTION:

- A. Where U-channel systems, angles, brackets or other standard structural metal shapes are readily accessible and exposed to personnel, provide plastic or rubber end caps.
- B. Where threaded rod supports are readily accessible and exposed to personnel, provide plastic or rubber end caps.

- 3.3 FIRE STOPPING LOCATIONS:
 - A. Preparation:
 - 1. Coordination: Coordinate the work with other trades. Fire stopping materials at penetrations of insulated pipes and ducts can be applied after insulation is in place. If insulation is composed of combustible material, the thickness of fire stopping materials must be equivalent to that of the insulation. If the insulation is composed of non-combustible material, it may be considered as part of the penetrating item.
 - 2. Surface Preparation: Surface Preparation to be in contact with fire stopping materials shall be free of dirt, grease, oil, loose material or other substances that may affect proper fitting or the required fire resistance.
 - B. Installation: Install fire stopping materials in accordance with the manufacturer's instructions.
 - C. Cleaning: After completion of fire stopping work in any area, equipment shall be reviewed and walls, ceilings and all other surfaces shall be cleaned of deposits of firestop materials.
 - D. Inspection: The architect may select, and the Owner will pay an independent testing laboratory to examine fire stopped areas to ensure proper installation prior to concealing or enclosing the fire stopped areas.

END OF SECTION 26 05 29

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SECTION 26 05 33 RACEWAY AND WIREWAY FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

- A. Extent of raceway work is indicated by drawings and schedules. Provide complete conduit systems for all conductors unless otherwise specified.
- B. Types of raceways specified in this section include the following:
 - 1. Electrical metallic tubing (EMT).
 - 2. Flexible metal conduit.
 - 3. Liquid-tight flexible metal conduit.
 - 4. Non-metallic Conduit and Ducts.
 - 5. Rigid metal conduit (RGC).
 - 6. Wireways.
 - 7. Rigid Aluminum Conduit.

1.2 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical raceway work similar to that required for this project.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of raceway system required. Include data substantiating the materials comply with requirements.
- C. Shop Drawings: Submit dimensioned drawings of surface metal raceway systems showing layout of raceways and fittings, spatial relationships to associated equipment, and adjoining raceways, if any. Show connections to electrical power panels and feeders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Subject to compliance with requirements, provide products by the following:
 - 1. Metallic Conduit:
 - a. Atkore
 - b. Wheatland
 - c. Western Tube & Conduit
 - d. Nucor Tubular

- 2. PVC Coated Conduit:
 - a. Atkore
 - b. Rob Roy
 - c. ABB
- 3. Non-Metallic Conduit:
 - a. Carlon
 - b. Can-Tex
- 4. Steel Fittings:
 - a. Hubbell
 - b. Emerson
 - c. Picoma
 - d. ABB
- 5. Conduit Bodies:
 - a. Hubbell
 - b. Appleton
 - c. Eaton
- 6. Wireway:
 - a. Schneider Electric Erickson Electric Equipment Co.
 - b. Hoffman Engineering Co.
- 2.2 METAL CONDUIT AND TUBING:
 - A. Rigid Galvanized Steel Conduit (RGC):
 - 1. Conduit: Rigid steel, zinc-coated inside and outside, threaded ends.
 - 2. Fittings: Threaded galvanized steel, bushings shall have nylon insulated throat.
 - B. PVC Externally Coated Rigid Steel Conduit:
 - 1. Conduit: Rigid steel zinc-coated with external coating of PVC.
 - 2. Fittings: Threaded galvanized steel with external PVC coating, bushings shall have nylon insulated throat.
 - C. Electrical Metallic Tubing (EMT):
 - 1. Conduit: Galvanized steel tubing.
 - 2. Fittings: Steel compression fittings for all applications. Connectors shall have insulated throat or threaded nylon bushing.
 - D. Rigid Aluminum Conduit:
 - 1. Not allowed unless otherwise noted.
 - E. Flexible Metal Conduit:
 - 1. Conduit: Continuous spiral wound, interlocked, zinc-coated steel, approved for grounding.

- 2. Fittings: Zinc coated, malleable iron. Straight connector shall be one-piece body, female end with clamp and deep slotted machine screw for securing conduit, and threaded male end provided with a locknut. Angle connectors shall be two-piece body with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and threaded male end provided with a locknut. All fittings shall be terminated with threaded bushings having nylon insulated throats.
- F. Liquid-Tight Flexible Metal Conduit:
 - 1. Conduit: Continuous spiral wound, interlocked zinc-coated steel with polyvinyl chloride (PVC) jacket, approved for grounding.
 - 2. Fittings: Zinc coated malleable iron. Straight and angle connectors shall be the same as used with flexible metal conduit but shall be provided with a compression type steel ferrule and neoprene gasket sealing rings.
- 2.3 NON-METALLIC CONDUIT AND DUCTS:
 - A. Rigid Non-Metallic Conduit (RNC):
 - 1. Conduit: Schedule 40 or 80 polyvinyl chloride (PVC), 90°C for direct burial or concrete encasement.
 - 2. Fittings: Mate and match conduit type and material. Cement as recommended by manufacturer.
 - B. PVC and ABS Plastic Utilities Duct:
 - 1. Conduit: Type 2 (EB) for encased burial in concrete; Type II (DB) for direct burial.
 - 2. Fittings: Mate and match conduit type and material. Cement as recommended by manufacturer.

2.4 CONDUIT BODIES:

- A. General: Types, shapes, and sizes, as required to suit individual applications and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.
- B. Metallic Conduit and Tubing: Use malleable iron conduit bodies. Use bodies with threaded hubs for threaded raceways and in hazardous locations.
- C. Nonmetallic Conduit: Use nonmetallic conduit bodies.

2.5 WIREWAYS:

- A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other components and accessories as required for complete system.
- B. Lay-In Wireways: Construct lay-in wireways with hinged covers in accordance with UL 870 with components UL listed. Construct units to be capable of sealing cover in closed position with sealing wire.
 - 1. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached so that removal is not necessary to utilize the lay-in feature.
 - 2. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.
- C. Rain-tight Troughs: Construct in accordance with UL 870, with components UL listed.

- 1. Construction: 16-gauge galvanized sheet metal parts for 4" x 4" to 6" x 6" sections, and 14-gauge parts for 8" x 8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate attaching to other NEMA 3R enclosures. Do not use Gasketing that can rip or tear during installation or would compromise rain-tight capability of the trough. Do not use cover screws that will protrude into the trough area and damage wire insulation.
- 2. Finish: Provide 14-gauge and 16-gauge galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

2.6 CONDUIT SIZES:

- A. Conduit sizes shall be as shown on the drawings. If the conduit size is not given on the drawings, the conduit shall be sized in accordance with NEC based on the number of conductors enclosed plus a parity sized equipment ground conductor and be subject to the following minimum sizes:
 - 1. Rigid, Intermediate, and EMT Conduit: 3/4-inch for all runs.
 - 2. Flexible and Liquid-Tight Flexible Conduit: 1/2-inch for all runs.
 - 3. Underground or Concrete Encased Nonmetallic Conduit: 3/4-inch for all runs.
 - 4. Conduits used for home runs shall contain only the conductors for the circuits indicated on the drawings. Combining multiple home runs into a single conduit will not be permitted.

2.7 RACEWAY SEALING COMPOUND:

A. Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 deg. F (1 deg. C), withstands temperature of 300 deg. F (149 deg. C) without slump, and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials and the common metals.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways. Provide notification in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 CONDUIT SCHEDULE:

- A. Raceways in all other areas shall be electrical metallic tubing unless otherwise noted.
- B. Buried Raceways: Schedule 40.
- C. Raceways embedded in concrete slabs or walls: Schedule 40, PVC plastic conduit.
- D. Exposed Raceways Subject to Corrosion, including Parking Garages and Parking Lots: PVC coated rigid steel galvanized conduit.
- E. Raceways Through Foundation Walls Below Grade: One 10-foot section of PVC coated rigid steel galvanized, extending from 1-foot inside the foundation wall.
- F. Hazardous areas: Rigid steel galvanized conduit.
- G. Raceways in locations subject to mechanical injury: Rigid steel galvanized conduit or intermediate metal conduit. Locations subject to mechanical injury include, but are not limited to, the following:

- 1. Exposed conduits outdoors up to 8 feet above finished grade.
- H. Equipment connections: PVC jacketed liquid-tight flexible metallic conduit with liquid tight connectors.
- I. Rework or extensions of existing conduit shall include the use of similar materials to the existing conduit type unless otherwise noted.

3.3 INSTALLATION OF CONDUITS:

- A. General: Install electrical raceways in accordance with manufacturer's written installation instruction, applicable requirements of NEC, and as follows:
 - 1. Complete installation of electrical raceways before starting installation of conductors within raceways.
 - 2. Provide supports for raceways as specified elsewhere in Division 26.
 - 3. Prevent foreign matter from entering raceways by using temporary closure protection.
 - 4. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bend is not visible above the finished slab.
 - 5. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
 - 6. Use raceway fittings that are types compatible with the associated raceway and suitable for the use and location. Install expansion fittings across all structural construction joints and expansion/deflection couplings across all structural expansion joints.
 - 7. Run raceways parallel and perpendicular to building elements and other equipment with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated.
 - 8. Raceways embedded in slabs: (Allowed only by written authorization of Structural Engineer/Architect): Install with a minimum of bends, in the shortest practical distance, in middle third of the slab thickness where practical, and leave at least 1 inch concrete cover. Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in the concrete. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab. Where nonmetallic conduit is used, raceways must be converted to PVC coated rigid steel conduit before rising above floor.
 - 9. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.
 - 10. Install vertical feeder conduits in exterior walls, core walls, or chase spaces. Do not install in interior wall partition areas.
 - 11. Run exposed and parallel raceways together. Make bends in parallel runs from the same center line so that the bends are parallel. Factory elbows may be used only where they can be installed parallel. In other cases, provide field bends for parallel raceways.
 - 12. Make raceway joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Joints in non-metallic conduits shall be made with solvent cement in strict accordance with manufacturer's recommendations.
 - 13. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. RGC and IMC shall be secured with double locknuts and an insulated metallic bushing. EMT shall be secured with one locknut and shall have nylon insulated throats or threaded nylon bushings from 1/2-inch to 1-inch. 1-1/4-inch and above shall be metal with nylon insulated throats. Use grounding type bushings for feeder conduits at switchboards, panelboards, pull boxes, transformers, motor control centers, VFD's, etc.
 - 14. Conduit sleeves shall have bushings as described for terminations.
 - 15. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

- 16. Provide nylon pull string with printed footage indicators having not less than 200 pounds tensile strength. Leave not less than 12 inches of slack at each end of the pull string. Identify with tags at each end the origin and destination of each empty conduit and indicate same on all empty or spare conduits on the asbuilt drawings.
- 17. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
 - a. Where conduits enter or leave hazardous locations.
 - b. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
 - c. Where conduits enter through a foundation wall or stub-up through a slab on grade floor.
 - d. Where required by the NEC.
- 18. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver-operated threaded plugs flush with floor.
- 19. Flexible Connections: Use short length (maximum of 6 feet) of flexible conduit, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid-tight flexible conduit in wet locations. Install separate equipment grounding conductor across flexible connections. Where PVC conduit/couplings have been approved for exterior use and are exposed to sunlight, provide UV rated PVC coatings or protect with 2 coats of water based latex paint that is chemically compatible with the PVC products. Color selection shall be by Architect.
- 20. PVC externally coated rigid steel conduit: Patch all nicks and scrapes in PVC coating after installing conduit.
- 21. Where conduits are to be installed through structural framing members, the Contractor shall provide sleeves. The Architect/Engineer's written approval must be obtained prior to cutting, notching, or drilling of structural framing members.
- 22. Ream the ends of all cut and/or threaded conduit. Ends shall be cut square.
- 23. Use of running threads for rigid or intermediate metallic conduit are not permitted. When threaded couplings cannot be used, provide 3-piece union or solid coupling.
- 24. Route conduit through roof openings for piping and ductwork where possible; otherwise, rout through jack with pitch pocket.
- 25. Conduit stub-ups from below grade or thru the slab shall be PVC coated or PVC taped rigid steel galvanized conduit and shall extend 6 inches above grade.
- 26. Wherever conduits enter a structure through a foundation or basement wall below grade, grout around the conduit with water-proof grout or install entrance seals. Seals shall be OZ Type WS or approved equivalent for new construction and OZ type CSM Series for existing structures.
- 27. Conduits shall not cross pipe shafts or ventilation duct openings. Where conduits must penetrate air-tight spaces or plenums, seal around the conduit with a mastic acceptable to the Architect/Engineer.
- 28. Install an insulated equipment grounding conductor in all conduits.
- 29. Where individual conduits penetrate existing fire-rated walls and floors, pack void around conduit with fire rated insulation and seal opening around conduit with UL listed foamed silicone elastomer compound. Where conduits penetrate exterior walls, new floors, or roof, provide pipe sleeve one size larger than conduit, pack void around conduit with fire rated insulation, and seal opening around conduit with UL listed foam silicone elastomer compound. Isted foam silicone elastomer compound.
- 30. Where conduit sleeves penetrate fire rated floors or walls for installation of system cables, AC or MC cables, or modular wiring cables pack void around cables or empty sleeve with fire rated insulation and fill ends with fire-resistive compound. Seal opening around sleeve with UL listed foam silicone elastomer compound.

- 31. Use PVC-coated rigid steel or Fiberglass factory elbows for bends in plastic conduit runs longer than 100 feet, or in plastic conduit runs which have more than two bends regardless of length. Use long sweep bends for wiring larger than 350 KCMIL.
- 32. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.
- 33. No PVC conduit shall be run exposed or inside stud or masonry walls unless specifically called for on the drawings. Transition from PVC to metal conduit shall be made below grade.
- 34. Provide rebar and tie downs for all conduits and conduit racks to be installed with concrete or slurry to prevent conduit "float".
- B. Install buried electrical line warnings per Division 26 section "Electrical identification".
- C. Install labeling as required in Division 26 section "Electrical Identification".

3.4 INSTALLATION OF WIREWAYS:

- A. Wireways: Mechanically assemble metal enclosures and raceways to form continuous electrical conductor and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.
 - 1. Where practicable, avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
 - 2. Install expansion fittings in all raceways wherever structural expansion joints are crossed.
 - 3. Make changes in direction of raceway run with proper fittings, supplied by raceway manufacturer. Field bends of raceway sections are not permitted.
 - 4. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.
 - 5. Use boxes as supplied by raceway manufacturer wherever junction, pull or device boxes are required. Standard electrical "handy" boxes, etc., are not permitted for use with surface raceway installations.
 - 6. Install an insulated grounding conductor in all wireways and surface raceways. Bond grounding conductor to all wireways and surface raceways.
 - 7. Wireways are acceptable only where specifically indicated on the drawings. The proposed use of surface raceways and wireways shall be submitted for review by the Engineer prior to installation.
 - 8. Common wireways are not acceptable for convergence of multiple circuits unless specifically indicated on the drawings. The proposed use of a common wireway shall be submitted for review by the Engineer prior to installation.
 - 9. The proposed use of wireways above or below panelboards, switchboards, motor control centers, and other electrical equipment shall be submitted along with a layout drawing for review by the Engineer prior to installation.

3.5 ADJUSTING AND CLEANING:

A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

END OF SECTION 26 05 33

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SECTION 26 05 34 CABINETS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY:

- A. This section includes cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this section include:
 - 1. Outlet and device boxes
 - 2. Pull and junction boxes
 - 3. Cabinets
 - 4. Hinged door enclosures
 - 5. Boxes and fittings for hazardous locations
- B. Conduit-body-type electrical enclosures and wiring fittings are specified in the Division 26 Section on Raceways.

1.2 DEFINITIONS:

- A. Cabinets: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.
- B. Device Box: An outlet box designed to house a receptacle device, or a wiring box designed to house a switch.
- C. Enclosure: A box, case, cabinet, or housing for electrical wiring or components.
- D. Hinged Door Enclosure: An enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box.
- E. Outlet Box: A wiring enclosure where current is taken from a wiring system to supply utilization equipment.
- F. Wiring Box: An enclosure designed to provide access to wiring systems or for the mounting of indicating devices or switches for controlling electrical circuits.
- 1.3 SUBMITTALS:
 - A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
 - B. Submit product data for cabinets and enclosures with classification higher than NEMA 1.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS:
 - A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cabinets:
 - a. Hoffman Engineering Co.

- b. Erickson Electrical Equipment Co.
- c. Schneider Electric
- 2. Boxes and Fittings for Hazardous Locations:
 - a. Eaton
 - b. Hubbell
 - c. Adalet-PLM.
 - d. Robroy
 - e. Appleton
- 2.2 CABINETS, BOXES, AND FITTINGS, GENERAL:
 - A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers including blank covers for unused boxes, knockout closures for unused openings and other accessories required for the intended use. Provide gaskets for units in damp or wet locations. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.
- 2.3 MATERIALS AND FINISHES:
 - A. Sheet Steel: Flat-rolled, code-gage, galvanized steel.
 - B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
 - C. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.
 - D. Cast Metal for Boxes, Enclosures, and Covers; Copper-free aluminum except as otherwise specified.
 - E. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
 - F. Painted Interior Finish: Where indicated, white baked enamel. Emergency system cabinets and boxes shall be red.
 - G. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connecters.

2.4 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES:

- A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application. For multiple device installations, use multi-gang boxes. Sectional boxes are not permitted. Provide barrier for different voltage conductors in the same box.
- B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be 4" square minimum with 2" depth minimum sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior/plaster rings and fixture studs.
- C. Cast Aluminum Boxes: Copper free aluminum deep type, with threaded raceway entries/hubs, and features and accessories suitable for each location including mounting ears, threaded screw holes for devices and closure plugs.

D. Malleable or Cast Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

2.5 PULL AND JUNCTION BOXES:

- A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.
- B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.
- C. Hot Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot dip galvanized after fabrication. Cover shall be gasketed.
- D. Stainless-Steel Boxes: Fabricate of stainless-steel conforming to Type 302 of ASTM A 167, "Specification for Stainless and Heat Resisting ChromiumNickel Steel Plate, Sheet, and Strip." Where necessary to provide a rigid assembly, construct with internal structural stainless-steel bracing. Cover shall be gasketed.
- E. Cast Aluminum Boxes: Molded of copper free aluminum, with gasketed cover and integral threaded conduit entrances and Neoprene gaskets.
- F. Malleable or Cast Iron Boxes: Molded of iron alloy with gasketed cover and integral threaded conduit entrances.
- G. Boxes Approved for Classified Locations: Cast metal boxes conforming to UL 886, "Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations," listed and labeled for use in the specific location classification, and with the specific hazardous material encountered. Conduit entrances shall be integral threaded type.

2.6 CABINETS:

- A. Comply with UL 50, "Electrical Cabinets and Boxes."
- B. Construction: Sheet steel, NEMA 1 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one-piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24 inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24 inches apart and not over 6 inches from top and bottom of door. For flush cabinets, make the front approximately 3/4-inch larger than the box all around. For surface mounted cabinets make front same height and width as box.
- C. Doors: Double doors for cabinets wider than 24 inches.
- D. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power, and lighting cabinets located within wire closets and mechanical and electrical rooms. Locks shall be of a type to permit doors to latch closed without locking.

- 2.7 STEEL ENCLOSURES WITH HINGED DOORS:
 - A. Comply with UL 50, "Cabinets and Enclosures" and NEMA ICS 6, "Enclosures for Industrial Controls and Systems."
 - B. Construction: Sheet steel, 16 gage, minimum, with continuous welded seams. NEMA class as indicated; arranged for surface mounting.
 - C. Doors: Hinged directly to cabinet and removable, with approximately 3/4-inch flange around all edges, shaped to cover edge of box. Provide handle operated, key locking latch. Individual door width shall be no greater than 24 inches. Provide multiple doors where required.
 - D. Mounting Panel: Provide painted removable internal mounting panel for component installation.
 - E. Enclosure: NEMA 1 except as indicated. Where door gasketing is required, provide neoprene gasket attached with oil resistant adhesive, and held in place with steel retaining strips. For all enclosures of class higher than NEMA 1, use hubbed raceway entrances.
- 2.8 CAST METAL ENCLOSURES WITH HINGED DOORS:
 - A. Copper free aluminum with bolted, hinged doors. Where used at hazardous (classified) locations, enclosures shall conform to UL and shall be listed and labeled for the classification of hazard involved.
- 2.9 MOLDED NONMETALLIC ENCLOSURES WITH HINGED DOOR:
 - A. General: Molded, glass fiber reinforced high impact strength polyester with bolt or screw secured doors and solid neoprene gaskets.

PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL:
 - A. Locations: Install items where indicated and where required to suit code requirements and installation conditions. Coordinate box locations with Architectural elements including casework, backsplash, door swings, etc.
 - B. Cap with Knock out closures all unused knockout holes where blanks have been removed and plug unused conduit hubs.
 - C. Support and fasten items securely in accordance with Division 26 Section on Supporting Devices.
 - D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated. Size boxes to accommodate wire pulling, splices, taps, equipment connections and code compliance.
 - E. Remove sharp edges where they may come in contact with wiring or personnel.

3.2 APPLICATIONS:

- A. Cabinets: Flush mounted, NEMA enclosure type 1 except as otherwise indicated.
- B. Hinged Door Enclosures Indoor: NEMA type 1 enclosure except as indicated.
- C. Hinged Door Enclosures Outdoors: NEMA Type 4. Install drip hood, factory tailored to individual units.

CABINETS, BOXES, AND FITTINGS

- D. Hinged Door Enclosures in Corrosive Locations: NEMA type 4X nonmetallic enclosure.
- E. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:
 - 1. Interior Dry Locations: Sheet steel, NEMA Type 1.
 - 2. Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R.
 - 3. Wet Locations: NEMA Type 4 enclosures.
 - 4. Corrosive Locations: NEMA Type 4X enclosures.
 - 5. Hazardous (Classified) Locations: NEMA type listed and labeled for the location and class of hazard indicated.
- F. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.
- 3.3 INSTALLATION OF OUTLET BOXES:
 - A. Outlets at Windows and Doors: Locate close to window trim. For outlets indicated above doors center outlets above the door opening except as otherwise indicated.
 - B. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions.
 - C. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.
 - D. Gasketed Boxes: At the following locations use malleable or cast metal, threaded hub type boxes with gasketed weatherproof covers:
 - 1. Exterior locations.
 - 2. Where surface mounted on unfinished walls, columns, or pilasters. (Cover gaskets may be omitted in dry locations).
 - 3. Where exposed to moisture laden atmosphere.
 - 4. High traffic areas (surface installations).
 - 5. Where indicated.
 - E. Mounting: Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles vertically, except above counter receptacles to be mounted horizontally. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side. Provide far side box supports, for electrical switch boxes installed on metal studs and provide stud to stud support for electrical receptacle boxes installed on metal studs.
 - F. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.
 - G. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

3.4 INSTALLATION OF PULL AND JUNCTION BOXES:

A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8 inches square by 4 inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed the following:

Size of Largest	Maximum no. of
Conductors in Box	Conductors in Box
No. 4/0 AWG	30
250 KCMIL	20
500 KCMIL	15
Over 500 KCMIL	10

- B. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 inches inside boxes.
- C. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling. Where possible, locate pull and junction boxes above accessible ceilings in finished areas.
- D. Flush in grade outdoor boxes shall be adequately supported against settling or tipping. Where heavy traffic or poor soil compaction exists, cast box in concrete base which provides 6" of cover around and under the box.

3.5 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES:

- A. Mount with fronts straight and plumb.
- B. Install with tops 78 inches above floor.
- C. Set cabinets in finished spaces flush with walls.

3.6 GROUNDING:

A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

3.7 CLEANING AND FINISH REPAIR:

- A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.
- B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the tray manufacturer.
- C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION 26 05 34

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

- 1.1 SUMMARY:
 - A. This Section includes underground conduits and ducts, duct banks, pull boxes and hand-holes, manholes and other underground utility structures.
 - B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 2 Section "Earthwork" for general requirements for excavation, backfill and related items for ducts, manholes and hand-holes.
 - 2. Division 3 Section "Cast-In-Place Concrete" for cast-in-place concrete requirements.
 - 3. Division 7 Section "Sheet Membrane Waterproofing" for waterproofing of manholes and hand-holes.
 - 4. Division 7 Section "Bituminous Damp-proofing" for damp-proofing of manholes and hand-holes.

1.2 DEFINITIONS:

- A. Duct: Electrical conduit and other raceway, either metallic or nonmetallic, used underground, embedded in earth or concrete.
- B. Duct Bank: 2 or more conduits or other raceway installed underground in the same trench or concrete envelope.
- C. Hand-hole: An underground junction box in a duct or duct bank.
- 1.3 SUBMITTALS:
 - A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
 - B. Product data for metal accessories for manholes and hand-holes, conduit and duct, duct bank materials, and miscellaneous components.
 - C. Shop drawings showing details and design calculations for precast manholes and hand-holes, including reinforcing steel. Stamp drawings with seal of registered professional structural engineer.
 - D. Certificate for concrete and steel used in underground precast concrete utility structures, according to ASTM C 858.
 - E. Inspection report for factory inspections, according to ASTM C 1037.
 - F. Coordination drawings showing duct profiles and coordination with other utilities and underground structures. Include plans and sections drawn to accurate scale.
 - G. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architect and Owner, and other information specified.
 - H. Field test reports indicating and interpreting test results relative to compliance with performance requirements of "Field Quality Control" Article in Part 3 of this Section.

I.Record Documents: Show dimensioned locations of underground ducts, hand-holes and manholes.UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS26 05 43 - 1

1.4 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: Firm experienced in manufacturing underground precast concrete utility structures of types and sizes required and similar to those indicated for this Project. Firm must have a record of successful in-service performance.
- B. Comply with NFPA 70 "National Electrical Code" and ANSI C2 "National Electrical Safety Code" for components and installation.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. Coordinate layout and installation of ducts, manholes, and hand-holes with final arrangement of other utilities as determined in the field.
- E. Coordinate elevations of duct and duct bank entrances into manholes and hand-holes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and ensure duct runs drain to manholes and hand-holes, and as approved by the Architect.
- 1.5 DELIVERY, STORAGE, AND HANDLING:
 - A. Deliver ducts to site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping and deforming.
 - B. Store precast concrete units at site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
 - C. Lift and support precast concrete units only at designated lifting or supporting points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
 - 1. Underground Precast Concrete Utility Structures:
 - a. Precast Division; Carder Concrete Products.
 - b. Christy Concrete Products, Inc.
 - c. Elmhurst-Chicago Stone Co.
 - d. Riverton Concrete Products.
 - e. A. Rotondo & Sons, Inc.
 - f. Oldcastle Enclosures
 - 2. Frames and Covers:
 - a. Campbell Foundry Co.
 - b. East Jordan Iron Works, Inc.
 - c. McKinley Iron Works, Inc.

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

- d. Neenah Foundry Co.
- 3. Nonmetallic Ducts:
 - a. Arnco Corp.
 - b. CANTEX, Inc.
 - c. Carlon; Lamson & Sessions Company.
 - d. Pipe and Plastic Group; Certainteed Products Corp.
 - e. Spiraduct, Inc.
- 2.2 CONDUIT AND DUCT:
 - A. Rigid Steel Conduit: ANSI C80.1, galvanized.
 - B. Plastic-Coated Rigid Steel Conduit and Fittings: NEMA RN 1.
 - C. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, rated for use with 90 deg C conductors under all installation conditions.
 - D. PVC Conduit and Tubing Fittings: NEMA TC 3.
 - E. Rigid Plastic Underground Conduit: UL 651A, Type A PVC.
 - F. Rigid Plastic Underground Conduit: UL 651A, Type EB PVC.
 - G. Rigid Plastic Underground Conduit: High-density polyethylene, Schedule 40.
 - H. Rigid Plastic Underground Conduit: Fiberglass-reinforced epoxy.
 - I. Manufactured Bends: Not less than 36-inch (900 mm) radius.
 - J. Coilable Plastic Duct: NEMA TC 12.
- 2.3 PULL BOXES AND HANDHOLES:
 - A. Cast metal Boxes: Cast aluminum, sized as indicated, with outside flanges and recessed, gasketed cover for flush mounting. Nonskid finish on cover.
 - B. Fiberglass Hand-holes: Molded fiberglass, sized as indicated, with 6-inch square (150 mm) cable entrance at each side, weatherproof cover with nonskid finish.
 - C. Cover Legend: ELECTRIC.

2.4 CONSTRUCTION MATERIALS: //EDIT NOTE: DELETE PARAGRAPHS BELOW EXCEPT FOR UNUSUAL APPLICATIONS. REFER TO EVALUATIONS OF "SHEET MEMBRANE WATERPROOFING" AND "BITUMINOUS DAMP-PROOFING" SECTIONS FOR GUIDANCE IN MOISTURE-PROOFING OPTIONS.

- A. Damp-proofing: Conform to Division 7 Section "Bituminous Damp-proofing."
- B. Waterproofing: Conform to Division 7 Section "Sheet Membrane Waterproofing."

PART 3 - EXECUTION

- 3.1 APPLICATION:
 - A. Underground Ducts for Electrical Feeders: Direct buried plastic conduit.

3.2 EXAMINATION:

A. Examine site to receive ducts and manholes for compliance with installation tolerances and other conditions affecting performance of the underground ducts and manholes. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 EARTHWORK:

- A. Excavation and Backfill: Conform to Division 2 Section "Earthwork," but do not use heavy-duty, hydraulicoperated compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated. Replace removed sod as soon as possible after backfilling is completed. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching. Perform according to Division 2 Section "Landscape Work."
- C. Warning Tape: Tape specifically manufactured for marking and locating underground utilities. Tape shall be polyethylene film, 6 inches wide, 0.004 inches thick and a minimum strength of 1,750 psi. Tape shall carry continuous inscription naming the specific utility. Color shall be:
 - 1. Electric Red

Tape for nonmetallic utility lines shall have foil backing or wires sufficient for detection by metal detector to a depth of 3 feet. Tape to be run continuously from manhole to manhole and have 3 feet slack rolled up at each end.

D. Restore disturbed paving. Refer to "Cutting and Patching" in Division 1.

3.4 CONDUIT AND DUCT INSTALLATION:

- A. Install nonmetallic conduit and duct as indicated according to manufacturer's written instructions.
- B. Slope: Pitch ducts minimum of 4 inches per 100 feet (1:300) to drain toward manholes and hand-holes and away from buildings and equipment. Slope ducts from a high point in runs between 2 manholes to drain in both directions.
- C. Curves and Bends: Use manufactured elbows for stub-ups at equipment and at building entrances. Use manufactured long sweep bends. Use only factory fittings for elbows, bends or offsets. Field bending is not permitted. Risers to grade to be PVC coated steel elbows.
- D. Make joints in ducts and fittings watertight according to manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.
- E. Duct entrances to Manholes and Hand-holes: Space end bells approximately 10 inches (250 mm) on center for 5-inch (125 mm) ducts and varied proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without

forming a trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrances.

- F. Building Entrances: Transition from underground duct to conduit 10 feet (3 m) minimum outside the building wall. Use fittings manufactured for the purpose. Follow appropriate installation instructions below.
 - 1. Direct-Buried, Non-encased Duct Entering Non-waterproofed Walls: Install a Schedule 40 galvanizedsteel pipe sleeve for each duct. Caulk space between conduit and sleeve with duct-sealing compound on both sides for moisture-tight seal.
 - 2. Waterproofed Wall and Floor Entrances: Install a watertight entrance-sealing device with the sealing gland assembly on the inside. Anchor device into masonry construction with 1 or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.
- G. Separation Between Direct-Buried, Non-encased Ducts: 3 Inches (75 mm) minimum for like services, and 6 inches (150 mm) minimum between power and signal ducts.
- H. Stub-Ups: Use rigid steel conduit for stub-ups to equipment. For equipment mounted on outdoor concrete pads, extend steel conduit a minimum of 5 feet from edge of pad. Install insulated grounding bushings on the terminations. Couple steel conduits to the ducts with adapters designed for the purpose and then encase coupling with 3 inches of concrete.
- I. Sealing: Provide temporary closure at terminations of ducts that are wired under this Project. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15 psi (1.03 MPa) hydrostatic pressure.
 - 1. Provide nylon pull string with printed footage indicators having not less than 200 pounds tensile strength. Leave not less than 12 inches of slack at each end of the pull string. Identify with tags at each end the origin and destination of each empty conduit and indicate same on all empty or spare conduits on the asbuilt drawings.
- J. Pulling Cord: Install 100-pound-test nylon cord in ducts, including spares.
- K. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
 - 1. Where conduits enter or leave hazardous locations.
 - 2. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
 - 3. Where conduits enter through a foundation wall or stub-up through a slab on grade floor.
 - 4. Where required by the NEC.
- L. Install raceway/duct sealing compound inside of all underground raceways that stub into a building through a foundation wall or through a slab on grade floor.

3.5 FIELD QUALITY CONTROL:

- A. Testing: Demonstrate capability and compliance with requirements upon completion of installation of underground duct and utility structures.
 - 1. Duct Integrity: Rod ducts with a ball type mandrel ¼" (6 mm) smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove the obstructions and retest. The Contractor shall notify prior to commencing integrity testing to request observation of procedures.

- Water Tightness: Make internal inspection of manholes 3 months after completion of construction for indications of water ingress. Where leakage is noted, remove water and seal leak sources. Re-inspect after 2 months and reseal remaining leak sources. Repeat process at 2 month intervals until leaks are corrected.
- B. Correct installations where possible, and retest to demonstrate compliance. Otherwise, remove and replace defective products and retest.
- 3.6 CLEANING:
 - A. Pull brush through full lengths of ducts. Use round bristle brush with a diameter 1/2-inch (12 mm) greater than internal diameter of duct.

END OF SECTION 26 05 43

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

- A. This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:
 - 1. Buried electrical line warnings.
 - 2. Identification labeling for raceways, cables, and conductors.
 - 3. Operational instruction signs.
 - 4. Warning and caution signs.
 - 5. Equipment labels and signs.
- B. Identification required in this section shall apply to equipment furnished in Division 26 and any other applicable Divisions including Division 23.

1.2 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product Data for each type of product specified.
- C. Submit schedule of identification nomenclature to be used for identification signs and labels for each type of equipment.
- 1.3 QUALITY ASSURANCE:
- A. ANSI Compliance: Comply with requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems," with regard to type and size of lettering for raceway and cable labels.
 PART 2 - PRODUCTS
- 2.1 MANUFACTURERS:
 - A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Ideal Industries, Inc.
 - 2. Markal Corp.
 - 3. Panduit Corp.
 - 4. W.H. Brady, Co.
 - 5. 3M Company

2.2 ELECTRICAL IDENTIFICATION PRODUCTS:

A. Provide colored Adhesive Marking Tape for banding Wires and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width. Make each color band completely encircling cables, at penetrations of walls and floors, at each junction box and at 20-foot maximum intervals in straight runs.

- B. Underground Line Marking Tape: Metal-detector detectable, permanent, bright colored, continuous printed, plastic tape compounded for direct burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.
- C. Wire/Cable Designation Tape Markers: Vinyl or vinyl cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.
- D. Engraved, Plastic Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face for normal and white letters on red face for emergency, black letters on yellow face for UPS and punched for mechanical fasteners. Where required for ground connections, provide engraved legend in white letters on green face.
- E. Fasteners for Plastic Laminated and Metal Signs: Self-tapping stainless steel screws when screw ends do not protrude into working areas of equipment otherwise use number 10/32 stainless steel machine screws with nuts and flat and lock washers or rivets.
- F. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50 lb. minimum tensile strength, and suitable for a temperature range from minus 50 degrees F to 350 degrees F. Provide ties in specified colors when used for color coding.
- G. Adhesive Marking Tape for Device Cover Plates: 3/8-inch Kroy tape or Brother labels with 3/16-inch minimum height letters. Tape shall have black letters on clear background for normal and red letters on clear background for emergency. Embossed Dymo-Tape labels are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code. Clean surfaces to receive nameplates and labels and install nameplates and labels on front of equipment parallel with equipment/raceway/cable/wire/etc. lines.
- B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.
- C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- D. Identify Junction, Pull and Connection Boxes: Identification of systems and circuits shall indicate system voltage and identity of contained circuits on outside of box cover. Use self-adhesive marking tape labels at exposed locations and indelible black marker at concealed boxes.
- E. Underground Electrical Line Identification: During trench backfilling, for exterior underground power, signal and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker. Tape shall be 6 inches wide, 0.004 inches thick and 1750 psi minimum strength, trace wire run continuous length manhole to manhole and to equipment. Provide 3 feet slack rolled at each end.
 - 1. Install line marker for underground wiring, both direct-buried and in raceway. Red for electrical, orange for phone and cable.

- F. Circuit Identification: Tag or label conductors as follows:
 - 1. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
 - 2. Multiple Circuits: Where multiple branch circuits, control wiring or communications/signal conductors are terminated or spliced in a box or enclosure, label each conductor or cable with circuit number. For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.
 - 3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
- G. Apply warning, caution and instruction signs and stencils as follows:
 - Install warning, caution or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
 - 2. Emergency Operating Signs: Install, where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
 - a. Provide sign at main service entrance switch, indicating type and location of on-site stand-by generator as required by NEC. Sign shall read "Secondary Source Provided by Engine Generator Located in Room NAME and NUMBER".
- H. Install equipment/system circuit/device identification as follows:
 - Apply equipment identification labels of engraved plastic laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems unless unit is specified with its own self-explanatory identification. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.
 - a. Panelboards, electrical cabinets, and enclosures
 - b. Access doors and panels for concealed electrical items
 - c. Electrical switchgear and switchboards
 - d. Disconnect switches
 - e. Engine generators and all ancillary cabinets and equipment
 - f. Power transfer equipment
 - g. Control devices
- I. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere.
- J. For panelboards, provide framed, typed circuit schedules (label all spares and spaces in pencil) with explicit description and identification of items controlled by each individual breaker.
- K. Tag all grounding electrode conductors, associated bonding conductors, and grounding conductors at their point of attachment to any ground bus and grounding electrode (where possible) with a 2-inch

diameter round green phenolic nameplate. Lettering shall be 1/4-inch high with 1/4-inch between lines centered on the tag stating "DO NOT DISCONNECT," "MAIN GROUND." Nameplate shall attach to conductor with a short length of small chain.

- L. Install labels at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- M. Provide adhesive marking tape labels for identification of individual receptacles including receptacles. Locate tape on front of plate and identify panel and branch circuit serving the receptacle. Provide tape labels for identification of individual switches or thermal overload switches which serve as equipment disconnects. Locate the tape on the front of the cover-plate and identify panel and branch circuit serving the equipment.

END OF SECTION 26 05 53

SECTION 26 05 83 - WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY:

- A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Applications of electrical power connections specified in this section include the following:
 - 1. From electrical source to motor starters.
 - 2. From motor starters/motor controllers/VFD's/etc. to motors.
 - 3. To grounds including earthing connections.
 - 4. From push buttons to equipment requiring electrical connection.
 - 5. Other connections as shown.

1.2 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms with at least 2 years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product Data: Submit manufacturer's data on electrical connections for equipment products and materials. All mechanical and plumbing equipment shall be coordinated with unit nameplate information of the actual nameplate to be included on the equipment. As a minimum, information shall include: Operating Voltage; MCA (Min. circuit amperes); FLA (Full load amperes); MFS (Max. fuse size) or MOCP (Max. overcurrent protection); and SCCR (Short Circuit Current Rating) and shall match electrical equipment and protection/distribution sizes and be rated for available short circuit currents as shown on the drawings. Bracing for equipment shall be provided at incoming terminals and as an option throughout the equipment for the available fault current or downstream equipment and devices shall be protected by current limiting fuses.

1.4 DEFINITIONS:

- A. Load voltage wiring shall be defined as:
 - 1. Conduit and wiring required to carry power to motors and other equipment or devices. Wiring from control devices to equipment that carry power to drive that equipment such as line voltage thermostats, etc., shall be included as load voltage wiring. Wiring that provides power to control panels, control transformers, control relays, time clocks, etc., shall also be included as load voltage wiring.

- 1.5 DELIVERY, STORAGE, AND HANDLING:
 - A. Deliver electrical connection products wrapped in proper factory fabricated type containers.
 - B. Store electrical connection products in original cartons and protect from weather, construction traffic and debris.
 - C. Handle electrical connection products carefully to prevent breakage, denting, and scoring finish.

PART 2 - PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS:
 - A. Manufacturer: Subject to compliance with requirements, provide circuit and motor disconnects by one of the following:
 - 1. ABB
 - 2. Eaton
 - 3. Schneider Electric
 - 4. Siemens Energy & Automation, Inc.
- 2.2 GENERAL:
 - A. Overcurrent Protective Devices (OCPDs): Provide type, rating, and features as indicated. Comply with Division 26 Section on Low Voltage Circuit Protective Devices, with OCPDs adapted to equipment connection installation. Tandem circuit breakers shall not be used. Multiple breakers shall have common trip.

2.3 MATERIALS AND COMPONENTS:

- A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable insulating tubing, cable ties, solderless wire-nuts, disconnect, starter, contactor, relays, etc., and other items and accessories as needed to complete splices and terminations of types indicated.
- B. Metal Conduit, Tubing and Fittings:
 - 1. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type of service. Provide products complying with Division-26 section on Raceways.
- C. Wires, Cables, and Connectors:
 - 1. General: Provide wires, cables, and connectors complying with Division-26 section on Wires and Cables.
 - 2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes, ratings, and material of wires/cables which are supplying electrical power.
 - 3. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals recommended by equipment manufacturer for intended applications.
 - 4. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, electrical solder, electrical soldering flux, wire-nuts and cable ties as recommended for use by accessories manufacturers for type services indicated.
 - 5. Cord and Plug Connected Equipment: Where indicated, contractors shall provide a length of SO cord complete with a straight blade or twist-lock receptacle for connection of equipment. Cord and plug rating

shall be suitable for the connected equipment load and rating of the branch circuit overcurrent protective device. Plug shall match receptacle configuration included on the plans and cord length shall be as required. Contractor shall connect cord to equipment.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS:

- A. Coordinate with other work, including wires/cables, raceway, and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
- B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- C. Maintain existing electrical service and feeders to equipment serving occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Architect/Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
- D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of the spliced conductors.
- E. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torqueing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torqueing values contained in UL's 486A.
- H. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
- I. Provide suitable strain relief clamps for cord connection to outlet boxes and equipment connection boxes.
- J. Make wiring connections in control panel or in wiring compartment of pre-wired equipment and interconnecting wiring in accordance with manufacturer's instructions.

- K. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated or per manufacturer's instructions.
- L. Provide circuit disconnect switches as indicated and where required by Code. Comply with switch manufacturers printed installation instructions. Install within sight of motors.

3.3 FIELD QUALITY CONTROL:

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION 26 05 83

PART 1 - GENERAL

1.1 SUMMARY:

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Receptacles.
 - 2. Ground-fault circuit interrupters.
 - 3. Wall-plates.
 - 4. Plugs and connectors.

1.2 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 2 years of successful installation experience on projects utilizing wiring devices similar to those required for this project.
- C. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code", Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Samples of device plates for color selection and evaluation of technical features shall be submitted.

1.4 COORDINATION:

- A. Wiring Devices for Owner Furnished Equipment: Match devices to plug connectors for Owner-furnished equipment.
- B. Cord and Plug sets: Match cord and plug sets to equipment requirements.

PART 2 - PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS:
 - A. Manufacturers: Products shall be of the same manufacturer insofar as possible. Subject to compliance with requirements, provide wiring devices of one of the following:
- 1. Devices, Cover Plates, Accessories:
 - a. Hubbell Inc.
 - b. Leviton Mfg. Co.
 - c. Legrand
 - d. Eaton
 - e. Abb
- 2. Weatherproof Receptacle Covers:
 - a. Hubbell, Inc.
 - b. Legrand
 - c. Eaton
 - d. Leviton

2.2 WIRING DEVICES:

- A. Devices shall be lvory White. All receptacles and switches connected to circuits served from a generator system shall have a red face.
- B. Receptacles:
 - All duplex, Ground Fault Interrupter (GFCI), and other special receptacles shall be minimum, specification grade commercial series, listed by Underwriter's Laboratories, UL 498 and Federal Specification FS W-C-596, 20 amp, nylon face and have a metal mounting strap with self-grounding and have a hex-head green grounding screw and be side and back wired. Each device shall bear the UL/FS Label. Meet NEMA standards for wiring devices including NEMA WD 1 for general requirements and NEMA WD 6 for dimensional standards.
 - a. Each device shall have terminal screws and clamps listed for use with stranded wire.
 - 2. Convenience Receptacle Configuration: Duplex or Single as indicated on the drawings, Type 5-20R.
 - 3. Weather Resistant Receptacles: In addition to the above requirements all receptacles in damp and wet locations shall be WR (Weather Resistant) labeled.
 - 4. Special Purpose Receptacle Configuration: straight blade or locking as indicated on drawings, black face.
 - 5. Ground Fault Interrupter Receptacles: Where indicated or required provide "local reset" auto monitoring "self test" ground fault circuit interrupters. Provide unit capable of being installed in a 2-3/4" deep outlet box without adapter, grounding type, Class A, Group 1 per UL Standard 943. Provide visual indication of lost protection.

2.3 WIRING DEVICE ACCESSORIES:

- A. Device color to match Wiring Device Color identified above. Verify location, height, mounting conditions, etc., of all devices with Architectural drawings prior to rough-in.
- B. Wall-plates: Provide wall-plates of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates. Identify all wall plates used for receptacles with branch circuit number per requirements of section on Electrical Identification. Provide plates possessing the following additional construction features:
 - 1. Cast Metal or Aluminum: Die cast profile, ribbed for strength, flash removed, primed with gray enamel.
 - 2. Gaskets: Resilient rubber or closed cell foam urethane.

- 3. Weatherproof, Exterior and other wet locations and where called out on the drawings as "WP", provide weatherproof junction box with gaskets and cover.
 - a. "In Use" type: Cover shall be rated "while in use". Use low profile type covers with UV rated and resistant polycarbonate.
 - b. Outlet box hood shall be listed as "extra duty".

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical boxes, and wiring work, as necessary to interface installation of wiring devices with other work.
- C. Install wiring devices only in electrical boxes which are clean, free from excess building materials, dirt, and debris.
- D. Install wiring devices after wiring work is completed.
- E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds. 486A.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES:

A. Upon installation of wall-plates and receptacles, advise Contractor regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 GROUNDING:

A. Provide equipment grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Std. 486A to assure permanent and effective grounds.

3.4 CLEANING:

A. Internally clean devices, device outlet boxes and enclosures. Replace stained, cracked, damaged or improperly painted wall plates or devices. Remove temporary markings of labels.

3.5 TESTING:

- A. Prior to energizing circuitry, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained and prepare test reports. After energization, test wiring devices to demonstrate compliance with requirements.
 - 1. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices or similar problems.
 - 2. Tests for Convenience Receptacles:

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- a. Line Voltage: Acceptable range is 114 to 126 V.
- b. Ground Impedance: Values of up to 2 ohms are acceptable.
- c. Polarity: Test for correct neutral conduct to neutral terminal connection.
- d. Using the test plug, verify that the device and its outlet box are securely mounted.
- e. GFCI Receptacles: Test for tripping values specified in UL 1436 and UL 943. Test with both local and remote fault simulations in accordance with manufacturing recommendations.
- 3. Test Instruments:
 - a. Use instruments that comply with UL 1436.
 - b. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Correct Deficiencies and Report:
 - 1. Correct unsatisfactory conditions and retest to demonstrate compliance; replace devices as required to bring system into compliance.
 - 2. Correct malfunctioning units on-site, where possible and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Prepare a report that identifies enclosure, units, conductors, and devices checked and describe results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

END OF SECTION 26 27 26

SECTION 26 28 00 - LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY:

- A. This section includes overcurrent protective devices (OCPD's) rated 600 V and below and switching devices commonly used with them.
- B. Panelboards, Switchboards, and Motor Control Centers: Application, installation, and other related requirements for overcurrent protective device installations in distribution equipment are specified in other Division 26 sections.

1.2 DEFINITIONS:

- A. Overcurrent Protective Device (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.
- B. Ampere Squared Seconds: An expression of available thermal energy resulting from current flow. With regard to current limiting fuses and circuit breakers, the ampere squared seconds during fault current interruption represents the energy allowed to flow before the fuse or breaker interrupts the fault current within its current limiting range.
- 1.3 SUBMITTALS:
 - A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
 - B. Product data for fuses, fusible switches, circuit breakers, and OCPD accessories specified in this Section, including descriptive data and time current curves for all protective devices and let through current curves for those with current limiting characteristics. Include coordination charts and tables and related data.
 - C. Submit documentation of compliance with Code and Specification requirements for circuit protective devices including but not limited to SCCR, Listings for use with downstream breakers/fuses and equipment where required, Ground Fault protection.

1.4 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of overcurrent protective devices of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Each type of OCPD shall be the product of a single manufacturer.

PART 2 - PRODUCTS:

- 2.1 MANUFACTURERS:
 - A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Circuit Breakers:
 - a. Schneider Electric

LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

- b. ABB
- c. Siemens
- d. Eaton
- 2. When mounting overcurrent protective devices in switchboards, switchgear, panelboards, MCCs, etc., provide equipment of same manufacturer as equipment into which they are being mounted.

2.2 OVERCURRENT PROTECTIVE DEVICES (OCPDS), GENERAL:

- A. General: Provide OCPDs in indicated types, as integral components of panelboards, switchboards, motor control centers, and other related equipment; and as individually enclosed and mounted single units.
- B. Enclosures: NEMA 250 "Enclosures for Electrical Equipment (1,000 Volts Maximum)."
- C. Where OCPDs are to be installed in existing panelboards, switchboards, and motor control centers, they shall be of the same manufacture and type as those existing in the equipment. If this is not possible, provide devices which are compatible with the existing equipment and when installed will not void the U.L. label or reduce the short circuit rating of the equipment.
- D. All overcurrent devices shall be individually rated for the available fault current unless otherwise noted. Series ratings of equipment will only be allowed where specifically called out.
- E. Ground Fault Protection: Distribution circuit breakers: provide integral, self-powered type with mechanical ground fault indicator, test function, adjustable pickup current and delay time with inverse and constant time characteristics, internal memory arranged to integrate intermittent arcing ground faults, and ground fault current sensor located as indicated or required. Provide combination devices for branch circuit protection as follows; where shown or required provide 30 mA Ground Fault circuit breakers for each circuit feeding Electrical Heat Trace to protect from overheating and fire and 5 mA Ground Fault circuit breakers for each circuit feeding receptacles to protect personnel. Coordinate with manufacturer's instructions.
- 2.3 COMBINATION CIRCUIT BREAKERS AND GROUND FAULT CIRCUIT INTERRUPTERS:
 - A. General: UL 943 "Ground Fault Circuit Interrupters," arranged for sensing and tripping for ground fault current in addition to overcurrent and short circuit current. Provide features as follows:
 - 1. Match features and module size of panelboard breakers and provide clear identification of ground fault trip function.

2.4 CIRCUIT BREAKERS WITH SOLID-STATE TRIP DEVICES:

- A. General: In addition to other requirements as listed, all breakers indicated on the drawings as GFI, Zone interlock (Z), all adjustable trip breakers, if required for coordination, and all breakers 250 amp frame size and larger with solid-state trip devices having the following features:
 - 1. Ambient Compensation: Trip device insensitive to temperature changes between minus 20 degrees C and plus 55 degrees C.
 - 2. Adjustability: Breaker ratings and trip settings shall be changeable by operation of controls on front panel of breaker and by change of plug-in element without removing the breaker.
 - a. The trip device sensor shall have the same rating as the frame amperage of the circuit breaker unless noted otherwise.

3. Ground-Fault Tripping: Provide adjustable pick-up and time-delay on circuit breakers indicated with GFI.

2.5 OCPD ACCESSORIES:

A. Lock-Out Devices: Provide padlocking provisions on each overcurrent protective device, lockable in the open or closed position. Provide 3 sets of lockout/tagout devices for each type of breaker or switch provided. Include tags, locks and all accessories necessary.

PART 3 - EXECUTION:

- 3.1 INSTALLATION:
 - A. Independently Mounted OCPDs: Locate as indicated and install in accordance with manufacturer's written installation instructions. Install OCPDs level and plumb.
 - B. OCPDs in new distribution and branch circuit equipment shall be factory installed. OCPDs in existing distribution and branch circuit equipment shall match existing for type and be provided with features as listed herein.
 - C. OCPDs and mounting accessories installed in existing equipment shall match the existing manufacturer and be rated for the available fault current.

3.2 IDENTIFICATION:

- A. Identify components in accordance with Division 26 Section on electrical identification.
- 3.3 CONTROL WIRING INSTALLATION:
 - A. Install wiring between OCPDs and control/indication devices.

3.4 CONNECTIONS:

A. Check connectors, terminals, bus joints, and mountings for tightness. Tighten field connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.5 GROUNDING:

- A. Provide equipment grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.
- 3.6 FIELD QUALITY CONTROL:
 - A. Reports: Prepare written reports on tests and observations. Report defective materials and workmanship, and unsatisfactory test results. Include complete records of repairs and adjustments made. Tests shall be made on all new and existing OCPDs provided and/or connected under this project in accordance with this section.
 - B. Labeling: Upon satisfactory completion of tests and related effort, apply a label to tested components indicating test results, date, and responsible organization and person.

- C. Schedule visual and mechanical inspections and electrical tests with at least one week's advance notification.
- D. Upon completing installation of the system, perform the following tests on all new equipment and existing equipment as indicated on the drawings:
 - 1. Visual and mechanical inspection: Include the following inspections and related work.
 - a. Overcurrent Protective Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters.
 - b. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.
 - c. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
 - d. Check tightness of electrical connections of OCPDs with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
 - e. Clean OCPDs using manufacturer's approved methods and materials.
 - f. Verify installation of proper fuse types and ratings in fusible OCPDs.
 - 2. Electrical Tests: Perform the following tests in accordance with manufacturer's instructions:
 - a. Insulation resistance test of fused power circuit devices, insulated case, and molded case circuit breakers, 600ampere frame size and over at 1000 degree V D.C. for one minute from pole to pole and from each pole to ground with breaker closed and across open contacts of each phase. Insulation resistance less than 100 megohms is not acceptable.
 - b. Make insulation resistance tests of OCPD buses, components, and connecting supply, feeder, and control circuits.
 - c. Make continuity tests of circuits.
 - d. Provide full rated primary current tests conforming to IETA testing standards of all new and existing breakers 800 amperes and greater including Ground Fault systems testing, connected under this project. Inspect breakers and provide test report. Set breakers to previous or new settings as directed prior to test.
 - e. Verify relay operation by introduction of accurately metered currents into overcurrent/ground fault/ and other circuitry at values which will enable accurate determination of the tripping or activation values.
- E. Make adjustments for final settings of adjustable trip devices.
- F. Activate auxiliary protective devices such as ground fault or under-voltage relays, to verify operation of shunt trip devices.
- G. Check stored energy charging motors for proper operation of motor, mechanism, and limit switches.
- H. Check operation of electrically operated OCPDs in accordance with manufacturer's instructions.
- I. Check key and other interlock and safety devices for operation and sequence. Make closing attempts on locked open and opening attempts on locked closed devices including moveable barriers and shutters.
- J. Retest: Correct deficiencies identified by tests and observations and provide retesting of OCPDs by testing organization. Verify by the system tests that specified requirements are met.
- 3.7 CLEANING:
 - A. Upon completion of installation, inspect OCPDs. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

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3.8 DEMONSTRATION:

- A. Training: Demonstrate OCPDs and train Owner's maintenance personnel.
- B. Schedule training with at least seven days' advance notification.

END OF SECTION 26 28 00

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SECTION 311000 SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clearing and protection of vegetation.
- B. Removal of existing debris.

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 017000 Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- D. Section 024100 Demolition: Removal of built elements and utilities.

1.03 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Vegetation removal limits.
 - 2. Areas for temporary construction and field offices.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SITE CLEARING

- A. Comply with other requirements specified in Section 017000.
- B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

- A. Do not remove or damage vegetation beyond the limits indicated on drawings.
- B. Install substantial, highly visible fences at least 3 feet high (at least 1 m high) to prevent inadvertent damage to vegetation to remain:
 - 1. At vegetation removal limits.
- C. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.
- D. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
 - 1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.

- 2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches (450 mm).
- 3. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
- 4. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.
- E. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DEBRIS

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 312200 GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of topsoil.
- B. Rough grading the site for site structures.
- C. Finish grading.

1.02 RELATED REQUIREMENTS

- A. Section 311000 Site Clearing.
- B. Section 312316 Excavation.
- C. Section 312323 Fill: Filling and compaction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 312323.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the Work 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. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- E. When excavating through roots, perform work by hand and cut roots with sharp axe.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- G. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify building and trench backfilling have been inspected.
 - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove soil contaminated with petroleum products.

- C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches (75 mm).
- D. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- E. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.05 FIELD QUALITY CONTROL

A. See Section 312323 for compaction density testing.

END OF SECTION

SECTION 312316 EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for footings, slabs-on-grade, paving, and site structures.

1.02 RELATED REQUIREMENTS

- A. Section 024100 Demolition: Shoring and underpinning existing structures.
- B. Section 311000 Site Clearing: Vegetation and existing debris removal.
- C. Section 312200 Grading: Soil removal from surface of site.
- D. Section 312200 Grading: Grading.
- E. Section 312323 Fill: Fill materials, backfilling, and compacting.

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION

3.01 EXCAVATING

- A. Excavate to accommodate new structures and construction operations.
- B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

END OF SECTION

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SECTION 312323 FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, and site structures.
- B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 312200 Grading: Removal and handling of soil to be re-used.
- B. Section 312200 Grading: Site grading.
- C. Section 312316 Excavation: Removal and handling of soil to be re-used.

1.03 DEFINITIONS

1.04 SUBMITTALS

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

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Subsoil excavated on-site.
 - 1. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
- B. Topsoil: Topsoil excavated on-site.
 - 1. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

- A. Scarify and proof roll subgrade surface to a depth of 6 inches (150 mm) to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Slope grade away from building minimum 2 inches in 10 feet (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- F. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

- G. Compaction Density Unless Otherwise Specified or Indicated:
- H. Reshape and re-compact fills subjected to vehicular traffic.
- I. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILL AT SPECIFIC LOCATIONS

END OF SECTION

SECTION 321123 AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Paving aggregates.

1.02 RELATED REQUIREMENTS

A. Section 321313 - Concrete Paving: Finish concrete surface course.

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).

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements for submittal procedures.
- B. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate: Coarse aggregate, complying with SSPWC section 200-2.2, Crushed Aggregate Base

2.02 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements for general requirements for testing and analysis of aggregate materials.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Place aggregate in maximum 4 inch (100 mm) layers and roller compact to specified density.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for general requirements for field inspection and testing.

END OF SECTION

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SECTION 321313 CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks and stair steps.

1.02 RELATED REQUIREMENTS

- A. Section 031000 Concrete Forming and Accessories.
- B. Section 032000 Concrete Reinforcing.
- C. Section 033000 Cast-in-Place Concrete.
- D. Section 079200 Joint Sealants: Sealing joints.
- E. Section 321123 Aggregate Base Courses
- F. Section 321726 Tactile Warning Surfacing: Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

1.03 REFERENCE STANDARDS

- A. ACI 301 Specifications for Concrete Construction 2020.
- B. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).
- C. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
- D. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.
- E. ASTM C33/C33M Standard Specification for Concrete Aggregates 2018.
- F. ASTM C39/C39M Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.
- G. ASTM C94/C94M Standard Specification for Ready-Mixed Concrete 2022a.
- H. ASTM C150/C150M Standard Specification for Portland Cement 2022.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, and curing compound.

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES

A. Comply with applicable requirements of ACI 301.

2.02 FORM MATERIALS

A. Form Materials: As specified in Section 031000, comply with ACI 301.

2.03 REINFORCEMENT

- A. Reinforcing Steel and Welded Wire Reinforcement: Types specified in Section 032000.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa) yield strength; deformed billet steel bars; unfinished.
- C. Steel Welded Wire Reinforcement: Plain type, ASTM A1064/A1064M; in flat sheets; unfinished.

2.04 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: As specified in Section 033000.
- C. Cement: ASTM C150/C150M, Normal Type I Portland cement, gray color.
- D. Fine and Coarse Mix Aggregates: ASTM C33/C33M.

2.05 ACCESSORIES

A. Tactile Warning Surfaces: See Section 321726.

2.06 CONCRETE MIX DESIGN

- A. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- B. Concrete Properties:
 - 1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days, as specified in the Geotechnical Report.
 - 2. Fly Ash Content: As specified per Greenbook.
 - 3. Cement Content: As specified per Greenbook.
 - 4. Water-Cement Ratio: As specified per Greenbook.
 - 5. Maximum Slump: As specified per Greenbook.

2.07 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. See Section 321123 for construction of base course for work of this Section.
- B. Prepare subbase in accordance with State of _____ Highways standards.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.
- C. Notify Architect minimum 24 hours prior to commencement of concreting operations.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

- A. Place reinforcement as indicated.
- B. Interrupt reinforcement at contraction joints.

3.06 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Ensure reinforcement, inserts, embedded parts, formed joints and _____ are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- D. Apply surface retarder to all exposed surfaces in accordance with manufacturer's instructions.

3.07 JOINTS

A. Align curb, gutter, and sidewalk joints.

3.08 FINISHING

A. Area Paving: Light broom, texture perpendicular to pavement direction.

3.09 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch (6 mm) in 10 ft (3 m).

3.10 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.

END OF SECTION

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SECTION 32 92 19 – HYDRAULIC SEEDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Seeding.
 - 2. Hydroseeding.
 - 3. Native Grasses and Wildflowers
 - 4. Erosion-control material(s).
- B. Related Requirements:
 - 1. Section 32 91 13 "Soil Preparation and Soil Mixes".
 - 2. Section 32 91 19 "Landscape Finish Grading".
 - 3. Section 32 93 00 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 91 13 "Soil Preparation and Soil Mixes."
- E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- F. Integrated Pest Management (IPM): Ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates that they are needed, and they are selected

and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Contractor Conference with Seed Supplier: Contractor shall confirm with Seed Supplier seed mix application rates, required materials/components, installation means and methods, germination and support requirements, and maintenance practices.
- C. General: Integrated Pest Management (IPM) Practices shall be reviewed between the Contractor and the Client to determine the appropriate approach to managing issues with pests or weeds prior to determining whether pesticides or herbicides will be used.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer: Field Supervisor or Crew Foreman.
- B. Certification of Hydroseed Blends: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity and germination. No weed seeds allowed in each Lot. All seed mixes to be Pure Live Seed. Include the year of production and date of packaging.
 1. Ski Run Blend
- C. Product Certificates: For fertilizers, from manufacturer.
- D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of hydroseeded areas during a calendar year. Submit before expiration of required maintenance periods.
- B. Receipts of Purchased Seed Mix Quantities and Seed Carrier Quantities.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful native plants or grasses establishment for restoration or revegetation projects.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five years' experience in hydraulic mulching and hydroseeding installation in restoration or revegetation projects, in addition to requirements in Section 01 40 00 "Quality Requirements."

- 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
- 4. Personnel Certifications: Installer's field supervisor shall have certification from the Professional Landcare Network as a Landscape Industry Certified Technician Exterior, or 5 years of field experience.
- 5. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods: in fall from September to October after the first rainfall; or in the late spring following snowmelt, depending on condition of soil. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion till seed germination.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.10 WARRANTY

- A. General: Provide Warranty if it is requested by Owner, including the following provisions.
 - 1. Time Period: Warrant that grasses and wildflowers shall be in a healthy and flourishing condition of active growth six (6) months from date of Final Acceptance.
 - 2. Appearance During Warranty: Grasses and wildflowers shall be free of dead or dying patches, and all areas shall show foliage of a normal density, size and color.
 - 3. Delays: Delays caused by the Contractor in completing planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.
 - 4. Coverage: Warrant growth and coverage of hydroseeded planting to effect that a minimum of 95% of the area planted shall be covered with specified planting after one growing season with no bare spots.
 - 5. Exceptions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, or natural disaster during Warranty Period. Report such conditions in writing.

- 6. Confirmation: Contractor to confirm with Client that a Warranty is preferred, and duration of Warranty.
- B. If Owner declines Warranty, the Contractor shall evaluate conditions of planting at the ne of the first growing season following Substantial Completion. Areas that do not meet the specified germination rate shall be reseeded.

PART 2 - PRODUCTS

2.1 SEED AND SUPPLIERS

- A. Quality:
 - 1. Seed of grass species as listed below, with not less than 90 percent germination, not less than 100 percent pure live seed, and NO noxious or invasive weed seeds.
 - 2. Test seed of each species 12 months prior to mixing the seeds to confirm that the seeds are weed free. Provide written test results.
- B. Seed Suppliers:

Comstock Seed LLC, 917 Highway 88, Gardinerville, Nevada 89460

- 1. Telephone: 775.265-0090
- 2. Website: <u>www.comstockseed.com</u>
- 3. Contact: Eric Kleiner

2.2 SEED BLENDS

- A. Ski Run Blend (Mix #236222) Native Grasses, Shrubs and Wildflowers. Fresh, clean, dry, new crop, pure live seed, of mixed species as specified below.
 - 1. Elymus elymoides (Bottlebrush squirreltail) 2.0 lbs/acre
 - 2. Elymus trachycaulus ssp. Trachycaulus (Slender Wheatgrass) 4.0 lbs/acre
 - 3. Festuca trachyphylla (Fescue, Hard) 2.0 lbs/acre
 - 4. Festuca ovina (Fescue, Sheep) 2.0 lbs/acre
 - 5. Poa ampla (Big Bluegrass) 1.0 lbs/acre
 - 6. Leymus triticoides (Creeping Wild Rye) 1.0 lbs/acre
 - 7. Bromus marginatus (Bromegrass, Mountain) 3.0 lbs/acre
 - 8. Achillea millefolium (White yarrow) 0.15 lbs/acre
 - 9. Linum lewisii (Lewis Flax) 0.5 lbs/acre
 - 10. Penstemon rydbergii (Penstemon, Blue Mountain) 0.10 lbs/acre
 - 11. Ribes roezlii (Sierra Gooseberry) 0.15 lbs/acre
 - 12. Arctostaphylos nevadensis (Pinemat Manzanita) 0.25 lbs/acre

Application per Acre = 16.15 lbs/acre

B. Seed Carrier: Inert material, sharp clean sand or perlite to facilitate hydroseeding. Recommended mix at 1 part seed to 2-3 parts sand. Seed Carrier to Seed mix ratio may vary depending upon seed mix. Contractor to review mix ratio with Seed Supplier and Landscape Architect.

2.3 FERTILIZERS AND SOIL TESTS

- A. Soil Tests: Conduct Soil testing as specified below. To be completed for 3 locations within area to be hydroseeded, to determine soil amendments and compositions. Locations to be selected by Landscape Architect. Contact landscape Architect to confirm locations no less than 10 days prior to taking soil samples.
- B. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT WERA-103, including the following:
 - 1. Percentage of organic matter.
 - 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 - 3. Soil reaction (acidity/alkalinity pH value).
 - 4. Buffered acidity or alkalinity.
 - 5. Nitrogen ppm.
 - 6. Phosphorous ppm.
 - 7. Potassium ppm.
 - 8. Manganese ppm.
 - 9. Manganese-availability ppm.
 - 10. Zinc ppm.
 - 11. Zinc availability ppm.
 - 12. Copper ppm.
 - 13. Sodium ppm and sodium absorption ratio.
 - 14. Soluble-salts ppm.
 - 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 - 16. Other deleterious materials, including their characteristics and content of each.
- C. Recommendations: Provide test results in writing. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
 - 1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
 - 2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight [per 1000 sq. ft. for 6-inch depth of soil.
 - 3. Percolation Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil where adjustments to water infiltration are advisable to improve soil porosity for improved plant performance.
- D. Slow-Release Fertilizer: Biosol fertilizer, a 7-2-1 organically bound nitrogen fertilizer and soil conditioner which promotes the humus formation and soil fertility with 70% stable organic matter, or equivalent organic fertilizer as approved by Landscape Architect.
- E. Amendments: Nitrogen, phosphorous, potassium, and additional nutrients in amounts recommended in soil reports from a qualified soil-testing laboratory

2.4 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

- B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 10 percent and a pH range of 4.5 to 6.5.
- C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.5 SOIL STABILIZER AND TACKIFIER

- A. Soil Stabilizer Composition: totally organic substance supplied in powder form and at least 90% of which is 92% pure muciloid derived from ground Plantago ovata-insularis husks. Stabilizer shall be water-soluble, non-toxic hydrophilic and shall not inhibit germination.
- B. Soil Stabilizer and Tackifier Products:
 - 1. "Ecology Controls M-binder" by Ecology Controls (<u>www.ecologycontrol.com</u>);
 - 2. "PT-Tac Plantago Tacifier" by Fiber Marketing International (<u>www.fibermarketing.com</u>);
 - 3. "Turbo Tack" by Turbo Turf (<u>www.turboturf.com</u>); or equivalent as approved by Landscape Architect.

2.6 PESTICIDES OR INTEGRATED PEST MANAGEMENT

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.
- D. Integrated Pest Management (IPM): Identify effective strategies to prevent pests and their damage prior to utilizing pesticides or herbicides.

2.7 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.
- C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 4-inch nominal mat thickness

unless noted otherwise on drawings. Include manufacturer's recommended anchorage system for slope conditions.

D. Bonded Fiber Matrix: Wood fiber blanket bonded with tackifier that may also include seed and fertilizer. Applied by hydroseed truck or tank on slopes 2:1 or 2.5:1 at 3500 pounds per acre.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect existing structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.

3.3 HYDROSEEDED AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil and amendments according to Section 32 91 13 Soil Preparation and Soil Mixes.
- B. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- B. Other Erosion Control Options: Bonded Fiber Matrix apply at 3500 pounds per acre, per manufacturer's written instructions.

3.5 SEEDING IN AREAS NOT ACCESSIBLE BY HYDROSEEDING TRUCK

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph .
 - 1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate specified for each seed mix.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets. Protect seeded areas with slopes exceeding 1:6, but less than 1:4, with erosion-control fiber mesh. Install and staple erosion control according to manufacturer's written instructions.
- E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
- F. Protect seeded areas with slopes 2:1 or 2.5:1 from hot, dry weather or drying winds by applying wood chip or pine needle mulch within 24 hours after completing seeing operations. Soak areas and scatter mulch uniformly to a thickness of ½ inch to 1 inch, and roll surface smooth.

3.6 HYDROSEEDING BY TRUCK

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
 - 1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
 - a. Recommended tackifiers: M Binder at 200 lb/acre dry weight; or Plantago at 200 lb/acre; or Turbo Tack at 30 lb/acre. (Refer to Section 2.5-B Soil Stabilizer and Tackifier)
 - 2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 2000-lb/acre dry weight, and seed component is deposited at not less than the specified application rate.
 - 3. Evenly distribute seed by spraying in two directions at right angles to each other.

3.7 HYDROSEEDED AREA MAINTENANCE FOR ESTABLISHMENT

- A. Maintain and establish hydroseeded areas by weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable meadow. Roll, regrade, and replant bare or eroded areas, and re-mulch. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - 3. Apply treatments as required to keep hydroseeded area and soil free of pests and pathogens or disease. Use Integrated Pest Management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Hydroseeded areas will not have permanent irrigation. Temporary irrigation for seed establishment may be considered in high visibility areas. To be reviewed with Contractor and Owner, and to be confirmed prior to hydroseeding.
- C. Temporary Irrigation: As directed by Owner, install and maintain temporary piping, hoses, and meadow-watering equipment to convey water from sources and to keep hydroseeded area uniformly moist.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water hydroseeded area with fine spray at a minimum rate of 1/2 inch per week for eight weeks after planting unless rainfall precipitation is adequate.

3.8 PESTICIDE APPLICATION OR INTEGRATED PEST MANAGEMENT

- A. Contractor and Owner to determine if Pesticide Applications or Integrated Pest Management practices shall be followed for the hydroseeded areas.
- B. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat alreadygerminated weeds and according to manufacturer's written recommendations.

3.9 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by hydroseeding work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove nondegradable erosion-control measures after grass establishment period.

3.10 MAINTENANCE SERVICE

- A. Hydroseeded Area Services: Provide full maintenance by skilled employees of Landscape Installer. Maintain as required. Begin maintenance immediately after each area is planted and continue until acceptable plant growth is established, but for not less than maintenance period below.
 - 1. Maintenance Period: To be determined at time of Substantial Completion by germination rate and weather.

END OF SECTION 32 92 00